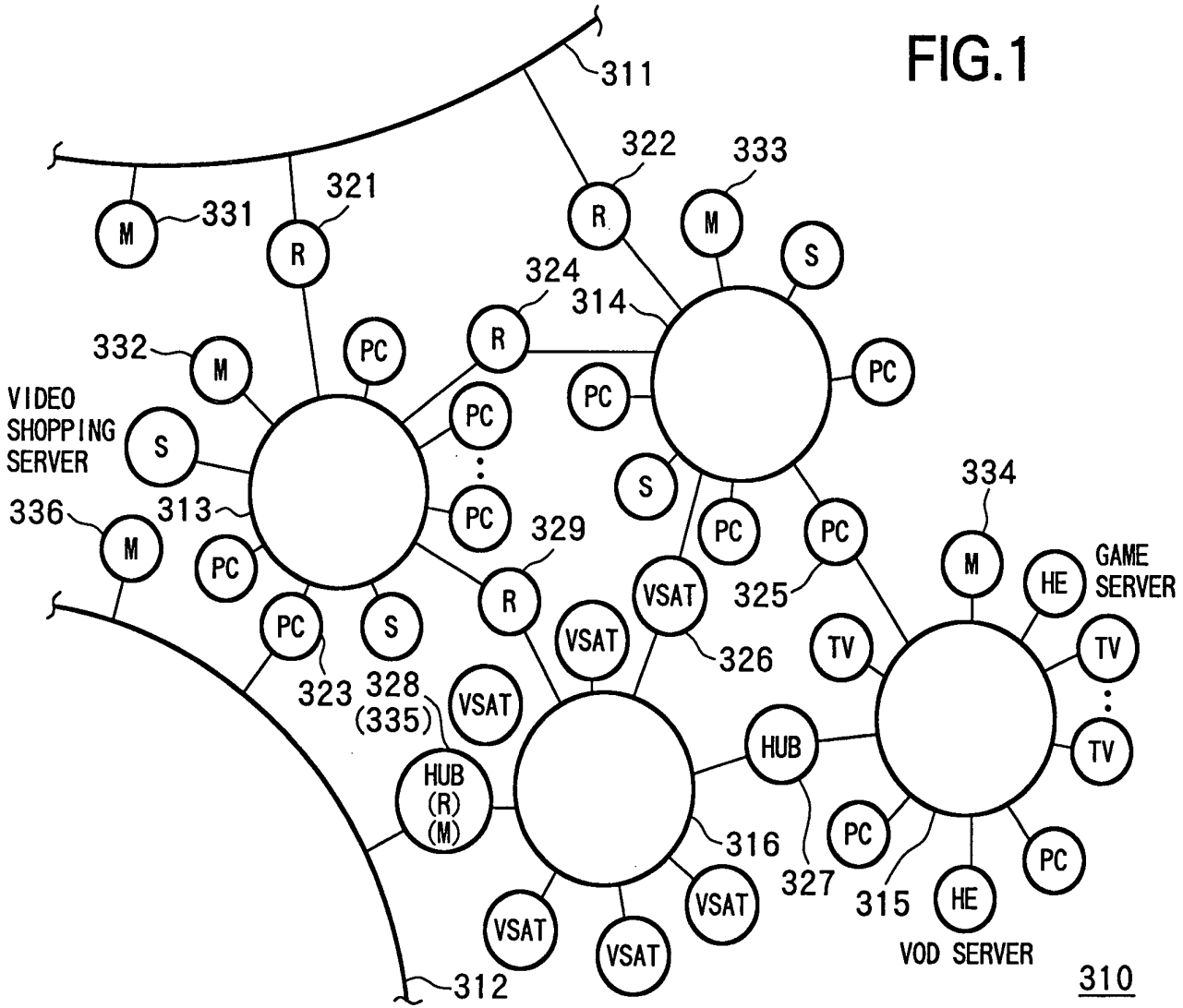
APPROVED O.G. FIG
BY
DRAFTSMAN

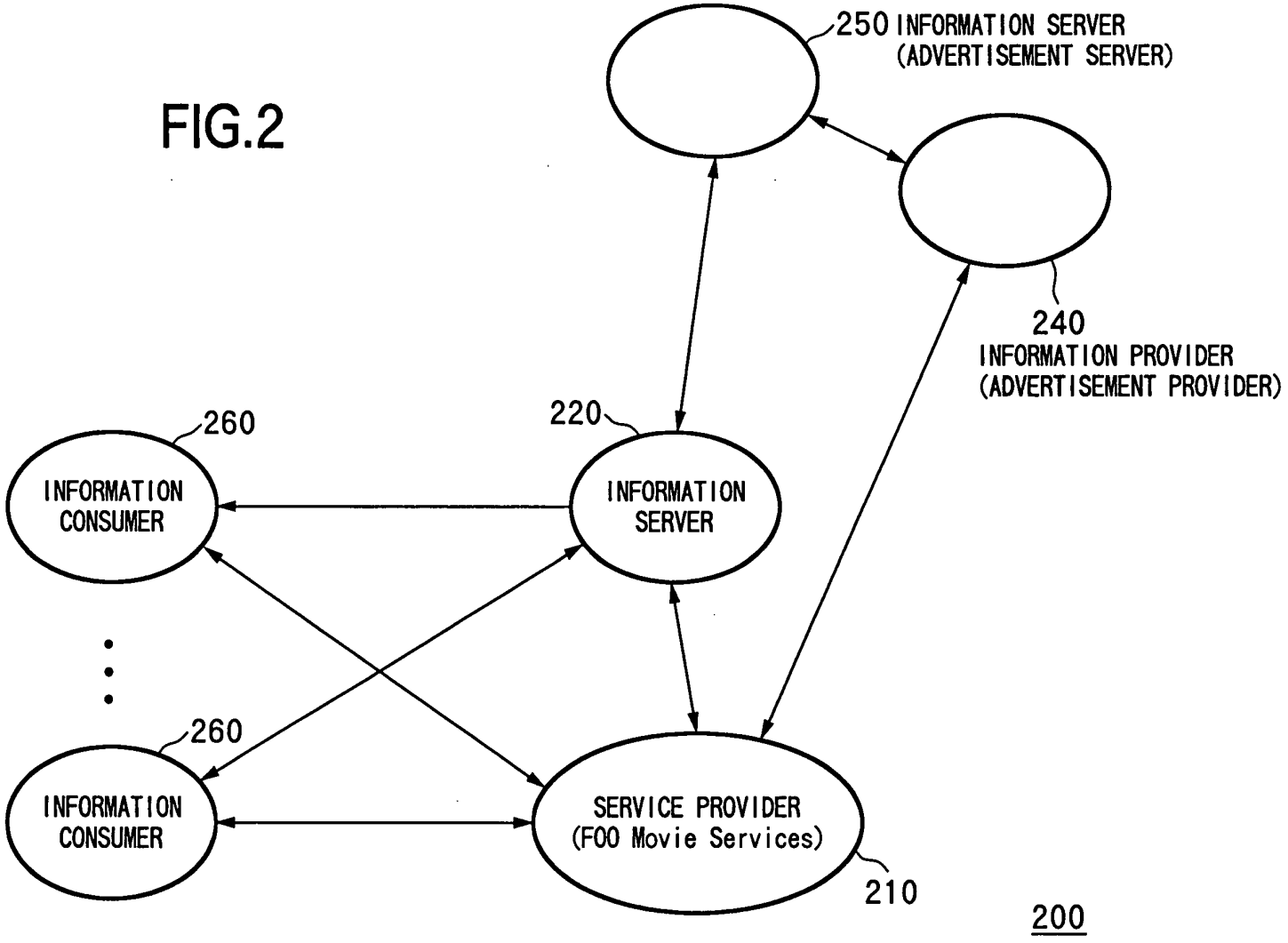
FIG.1



86h060" 2288hT60

APPROVED FOR PUBLIC RELEASE

FIG.2



APPROVED O.C. FIG.
BY
DEPARTMENT

FIG.3

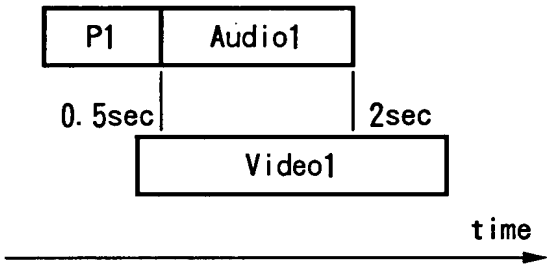
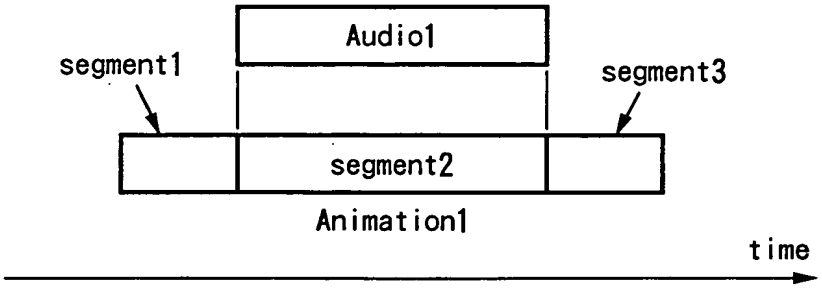
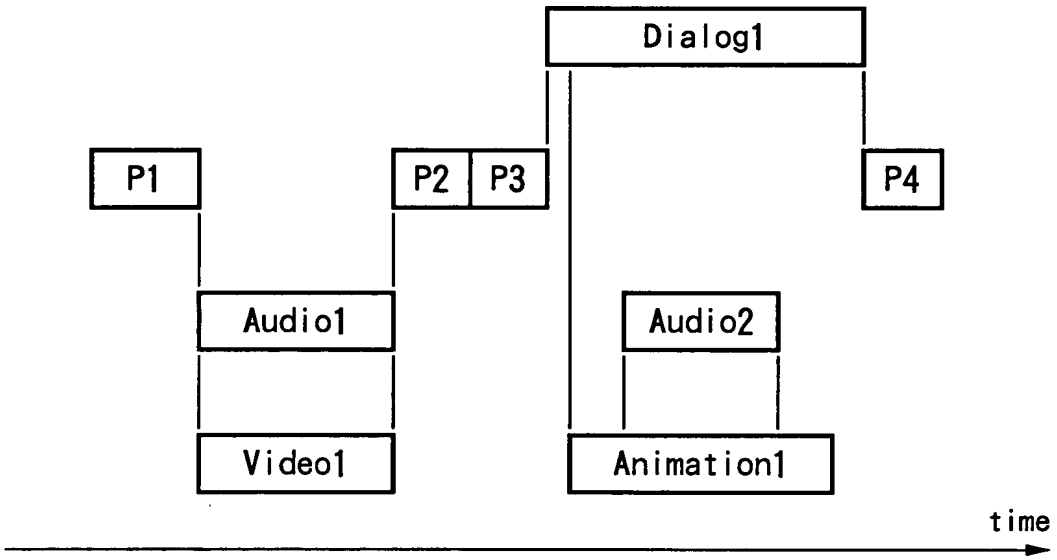


FIG.4



APPROVED O.G. FOR
BY
CLASS
DRAWING

FIG.5



APPROVED O.G. FIG
BY
DRAWING

FIG.6A

```
<!ENTITY picture1
        <picture hsize=300 vsize=200 color=256>
            <source> <local-link> picture-link1 </local-link> </source>
            </picture>>
<!ENTITY picture2
        <picture hsize=300 vsize=200 color=256>
            <source> <local-link> picture-link2 </local-link> </source>
            </picture>>
<!ENTITY picture3
        <picture hsize=300 vsize=200 color=256>
            <source> <local-link> picture-link3 </local-link> </source>
            </picture>>
<!ENTITY picture4
        <picture hsize=300 vsize=200 color=256>
            <source> <local-link> picture-link4 </local-link> </source>
            </picture>>
```

FIG.6B

```
<!ENTITY audio1
        <audio sampling-size=16>
            <source> <local-link> audio-link1 </local-link> </source>
            </audio>>
<!ENTITY audio2
        <audio sampling-size=16>
            <source> <local-link> audio-link2 </local-link> </source>
            </audio>>
```

APPROVED FOR PUBLICATION
BY
DPA

FIG.7A

```
<!ENTITY video1
        <video hsize=450 vsize=300 color=16 frame-rate=30>
            <source> <local-link> video-link1 </local-link> </source>
            </video>>
```

FIG.7B

```
<!ENTITY animation1
        <animation hsize=400 vsize=300 color=8 frame-rate=15>
            <source> <local-link> animation-link1 </local-link> </source>
            <segment begin=0 end=70> segment1 </segment>
            <segment begin=70 end=100> segment2 </segment>
            <segment begin=100> segment3 </segment>
            </animation>>
```

FIG.7C

```
<!ENTITY dialog1
        <dialog>
            <title> Movie Search </title>
            Search for <input type=text size=45> pattern </input>
            Joined by:<input type=radio value="AND"value="OR">
                                bool</input>
            Partial Match:<input type=radio value="Yes"value="No">
                                match</input>
            <input type=action value="Search"> search </input>
            <action> search
              <local-link> server-action-link1 </local-link>
             bool match <action>
            </dialog>
```

APPROVED
BY
CLASS

FIG.8A

```
<!ENTITY viewer1
        <viewer min-hsize=440 min-vsize=330> </viewer>>
```

FIG.8B

```
<open-window> & viewer1 </open-window>
<before delay=0 max-skew=500 duration=3> & picture1 & audio1 </before>
<while delay1=0 delay2=0 max-skew=80> & audio1 & video1 </while>
<before delay=0 max-skew=500> & audio1 & picture2 </before>
<before delay=0 max-skew=500 duration=2> & picture2 & picture3 </before>
<before delay=0 max-skew=500 duration=2> & picture3 & dialog1 </before>
<while delay1=0.5 delay2=2 max-skew=120> & animation1 & dialog1 </while>
<while delay1=0 delay2=0 max-skew=80>
        & audio2
        <sebsequence segment=segment2> & animation1 </subsequence>
        </while>
<before delay=0 max-skew=500> & dialog1 & picture4 </before>
```

APPROVED FOR PUBLIC RELEASE
BY
DTIC QUALITY INSPECTED

FIG.9

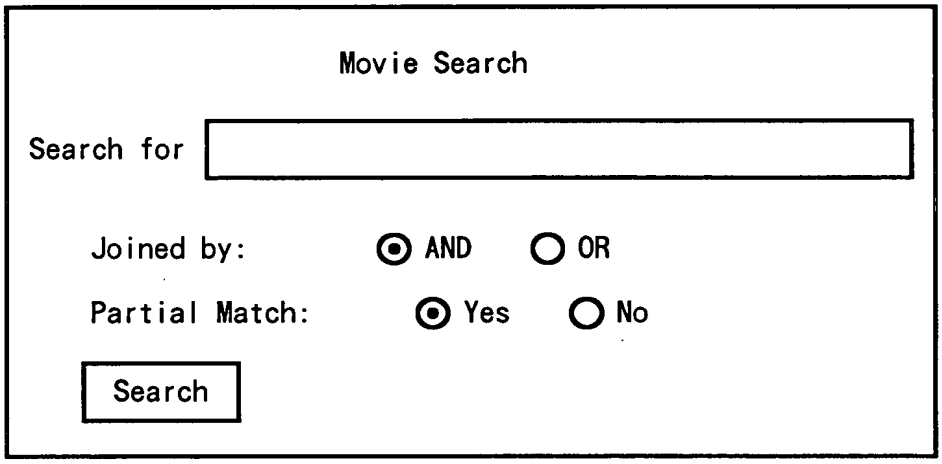
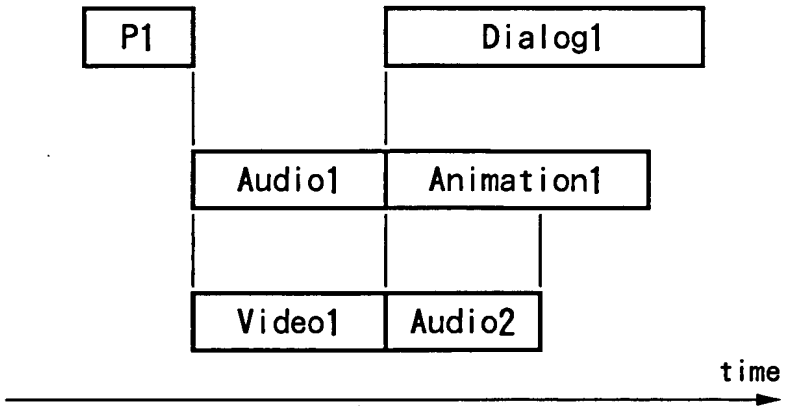
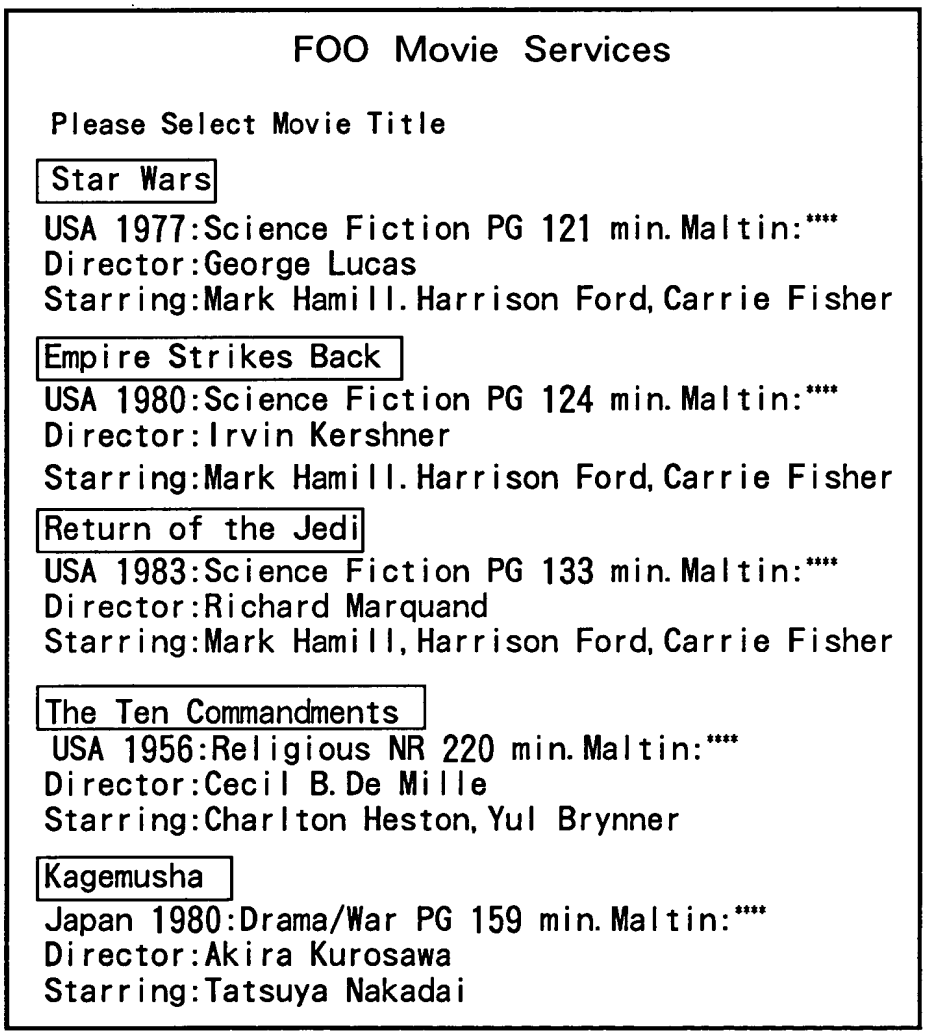


FIG.10



APPROVED FOR RELEASE
BY
DECLASS

FIG.11



DECLASSIFIED: E.O. 13526, SEC. 3.5

APPROVED
BY

FIG.12

```
<package>
   <title format=DVL version=2.0>
         <cover format=jpeg> & cover-description </cover>
         <name>"FOO Movie Services:MOVIE TITLES" </name>
         <sort> CONTENT <minor-sort> CATALOG </minor-sort> </sort>
         <system> PACKAGE-PROCESSOR </system>
         <structure> <linkage> <local-link> & linkage-part </local-link> </linkage>
                  <content-attributes> <local-link> & content-attribute-part </local-link>
                           </content-attributes>
                  <control-attributes> <local-link> & control-attribute-part </local-link>
                           </control-attributes>
                  <sequences> <local-link> & sequence-part </local-link> </sequences>
                  </structure>
         <!ENTITY cover-description {jpeg data body}>
         </title>
```

APPROVED FOR
BY
DRAWING

FIG.13

```
<!ENTITY linkage-part
<linkage>
   <link boundary=internal> <label> picture-link1 </label>
                net-resource://picture-server/picture11 </link>
   <link boundary=internal> <label> audio-link1 </label>
                net-resource://audio-server/audio11 </link>
   <link boundary=internal> <label> audio-link2 </label>
                net-resource://audio-server/audio12 </link>
   <link boundary=internal> <label> video-link1 </label>
                net-resource://video-server/video11 </link>
   <link boundary=internal> <label> animation-link1 </label>
                net-resource://animation-server/animation11 </link>
   <link boundary=external> <label> package-link2 </label>
                net-resource://package-server/package2
                <content>
                     <type> movie </type>
                     <provider> FOO Movie Services </provider>
                     </content>
               <control> admission-required <control>
               </link>
   <link boundary=external> <label> package-link3 </label>
               net-resource://package-sever/package3
               <content>
                     <type> movie </type>
                     <provider> FOO Movie Services </provider>
                     </content>
               <control> admission-required <control>
               </link>
```

0054-0053-0052-0051

APPROVED FOR PUBLICATION
BY
DATE

FIG.14

```
<link boundary=external> <label> package-link4 </label>
                net-resource://package-sever/package4
                <content>
                     <type> movie </type>
                     <provider> FOO Movie Services </provider>
                     </content>
                <control> admission-required <control>
                </link>
<link boundary=external> <label> package-link5 </label>
                net-resource://package-sever/package5
                <content>
                     <type> movie </type>
                     <provider> FOO Movie Services </provider>
                     </content>
                <control> admission-required <control>
                </link>
<link boundary=external> <label> package-link6 </label>
                net-resource://package-sever/package6
                <content>
                     <type> movie </type>
                     <provider> FOO Movie Services </provider>
                     </content>
                <control> admission-required <control>
                </link>
</linkage>>
```

APPROVED U.S. PATENT
BY
DRAWING

FIG.15

```
<!ENTITY content-attribute-part
    <content-attributes>
      <type> catalog </type>
      <provider> FOO Movie Services </provider>
      <release> July 1997 edition </release>
      <data> 1 July 1997 </data>
      <items> 5 </items>
      </content-attributes>>
<!ENTITY control-attribute-part
    <control-attributes>
      <billing> free </billing>
      <execution-environment>
                    <user-unit-requirement>
                      <memory-space> 2 </memory-space>
                      <graphics> 640×480×16 </graphics>
                      <audio> 16 </audio>
                      </user-unit-requirement>
                    </execution-environment>
      <encryption scheme=RSA key-sort=open> #87654321098765 </encryption>
      </control-attributes>
```

09/754,938 - 20030625

APPROVED O.G. FIG
BY
DRAFTSMAN

FIG.16

```
<!ENTITY sequence-part
  <sequences>
    <!ENTITY picture1
              <picture hsize=300 vsize=200 color=256>
                   <source> <local-link> picture-link1 </local-link> </source>
                   </picture>>
    <!ENTITY audio1
              <audio sampling-size=16>
                   <source> <local-link> audio-link1 </local-link> </source>
                   </audio>>
    <!ENTITY audio2
              <audio sampling-size=16>
                   <source> <local-link> audio-link2 </local-link> </source>
                   </audio>>
    <!ENTITY vidio1
              <video hsize=450 visize=300 color=16 frame-rate=30>
                   <source> <local-link> video-link1 </local-link> </source>
                   </video>>
    <!ENTITY animation1
              < animation hsize=400 vsize=300 color=8 frame-rate=15>
                   <source> <local-link> animation-link1 </local-link> </source>
                   </animation>>
    <!ENTITY dialog1
```

CONTENTS OF THE DIALOG1

```
    <!ENTITY viewer1
              <viewer min-hsize=440 min-vsize=330> </viewer>>
    <open-window> & viewer1 </open-window>
    <before delay=0 max-skew=500 duration=2> & picture1 & audio1 </before>
    <while delay1=0 delay2=0 max-skew=80> & audio1 & video1 </while>
    <before delay=0 max-skew=500> & audio1 & dialog1 </before>
    <cobegin delay=0 max-skew=120> & animational & dialog1 </cobegin>
    <while delay1=0 delay2=0 max-skew=80> & audio2 & animation1 </while>
    </sequences>>
  </package>>
```

APPROVED
BY
CLASS

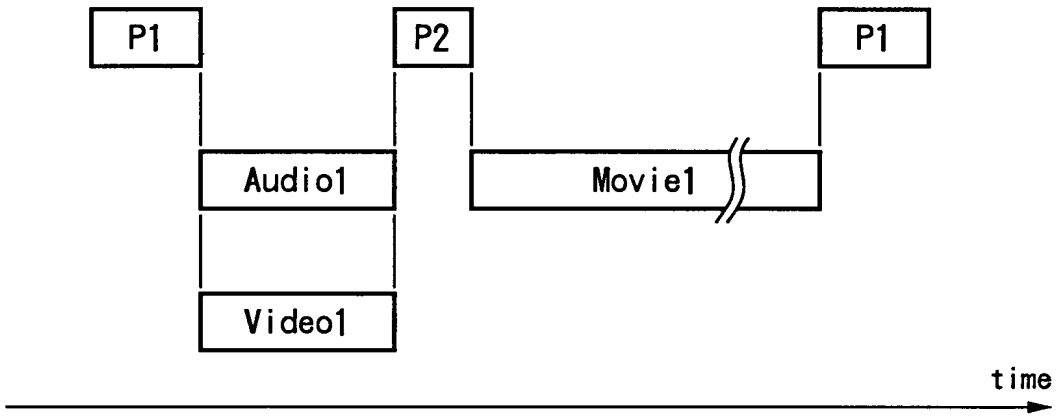
FIG.17

```
<dialog>
    <title> FOO Movie Services </title>
    Please Select Movie Title
    <action> take <local-link> package-link2 </local-link>
                "Star Wars"
               </action>
    USA 1977:Science Fiction PG 121 min. Maltin:****
    Director:George Lucas
    Starring:Mark Hamill, Harrison Ford, Carrie Fisher
    <action> take <local-link> package-link3 </local-link>
              "Empire Strikes Back"
               </action>
    USA 1980:Science Fiction PG 124 min. Maltin:****
    Director:Irvin Kershner
    Starring:Mark Hamill, Harrison Ford, Carrie Fisher
    <action> take <local-link> package-link4 </local-link>
                "Return of the Jedi"
                </action>
    USA 1983:Science Fiction PG 133 min. Maltin:****
    Director:Richard Marquand
    Starring:Mark Hamill, Harrison Ford, Carrie Fisher
    <action> take <local-link> package-link5 </local-link>
                "The Ten Commandments"
                </action>
    USA 1956:Religious NR 220 min. Maltin:****
    Director:Cecil B. De Mile </list>
    Starring:Charlton Heston, Yul Brynner
    <action> take <local-link> package-link6 </local-link>
                "Kagemusha"
                </action>
    Japan 1980:Drama/War PG 159 min. Maltin:****
    Director:Akira Kurosawa
    Starring:Tatsuya Nakadai
    </dialog>>
```

6th Oct 2000 16:56

APPROVED FOR PUBLIC RELEASE
BY
DPA/HQ/OSR

FIG.18



Doc Code: DRAWINGS

APPROVED BY ... ASG
DRAWING

FIG.19

```
<package>
 <title format=DVL version=2.0>
  <cover format=jpeg> & cover-description </cover>
  <name>"FOO Movie Services:Star Wars" </name>
  <sort> CONTENT <minor-sort> MOVIE </minor-sort> </sort>
  <system> PACKAGE-PROCESSOR </system>
  <structure> <linkage> <local-link> & linkage-part </local-link> <linkage>
        <content-attributes> <local-link> & content-attribute-part </local-link>
                             </content-attributes>
        <control-attributes> <local-link> & control-attribute-part </local-link>
                             </control-attributes>
        <sequences> <local-link> & sequence-part </local-link> </sequences>
        </structure>
  <!ENTITY cover-description {jpeg data body}>
  </title>
<!ENTITY linkage-part
 <linkage>
  <link boundary=internal> <label> picture-link1 </label>
                net-resource://picture-server/picture21 </link>
  <link boundary=internal> <label> picture-link2 </label>
                net-resource://picture-server/picture22 </link>
  <link boundary=internal> <label> audio-link1 </label>
                net-resource://audio-server/audio21 </link>
  <link boundary=internal> <label> video-link1 </label>
                net-resource://vidio-server/video21 </link>
  <link boundary=internal> <label> movie-link1 </label>
                net-resource://movie-server/movie21 </link>
  </linkage>>
```

Docket No. 8306.1010

APPROVED BY OIPE/DES

FIG.20

```
<!ENTITY content-attribute-part
  <content-attributes>
      <type> movie </type>
      <provider> FOO Movie Services </provider>
      <data> 1 July 1997 </data>
      <items> 1 </items>
      <material format=MPEG2> MOVIE </material>
      <content>
          <title> Star Wars <title>
          <type> Science Fiction </type>
          <producer> Gary Kurtz </producer>
          <director> George Lucas </director>
          <composer> John Williams </composer>
          <starring> Mark Hamill </starring>
          <starring> Harrison Ford
                  <occupation> Actor </occupation>
                  <born> July 13, 1942, Chicago, IL, USA </born>
                  <education> Ripon College, WI, USA </education>
                  </starring>
          <starring> Carrie Fisher </starring>
          <color> color </color>
          <length unit=minute> 121 </length>
          <year> 1977 </year>
          <country> USA </country>
          <language> English </language>
          <rating authority=MPAA> PG </rating>
          <review reviewer=Leonard Maltin> **** </review>
          <review reviewer=Baseline's Motion Picture Guide> ***** </review>
          <award authority=Academy> Art Direction/Set Decoration 1977 </award>
          <award authority=Academy> Costume Design 1977 </award>
          </content>
      </content-attributes>>
```

Docket No. 0756-1350

APPROVED FOR RELEASE
BY
DECLASS

FIG.21

```
<!ENTITY control-attribute-part
   <control-attributes>
      <billing unit=30 second amount=1.5 currency=JPY>
                     usage-based
                     <local-link> & movie1 </local-link>
                     </billing>
      <admitted-consumers>
                     <certification> FOO Movie Customers </certification>
                     </admitted-consumers>
      <access-conditions> parental-guidance </access-conditions>
      <execution-environment>
                     </user-unit-requirement>
                        <hard-drive-space> 40 </hard-drive-space>
                        <memory-space> 8 </memory-space>
                        <graphics> 640×480×16 </graphics>
                        <audio> 16 </audio>
                        <user-unit-requirement>
                  </execution-environment>
      <encryption scheme=RSA key-sort=open> #87654321098765 </encryption>
      </control-attributes>
```

BY

FIG22

```
<!ENTITY sequence-part
  <sequences>
    <!ENTITY picture1
          <picture hsize=300 vsize=200 color=256>
              <source> <local-link> picture-link1 </local-link> </source>
              </picture>>
    <!ENTITY picture2
          <picture hsize=300 vsize=200 color=256>
              <source> <local-link> picture-link2 </local-link> </source>
              </picture>>
    <!ENTITY audio1
          <audio sampling-size=16>
              <source> <local-link> audio-link1 </local-link> </source>
              </audio>>
    <!ENTITY video1
          <video hsize=450 visize=300 color=256 frame-rate=30>
              <source> <local-link> video-link1 </local-link> </source>
              </video>>
    <!ENTITY movie1
          <video hsize=450 vsize=300 color=256 format=MPEG2>
              <source> <local-link> movie-link1 </local-link> </source>
              </video>>
    <!ENTITY viewer2
          <viewer min-hsize=440 min-vsize=330> </viewer>>
    <open-window> & viewer2 </open-window>
    <before delay=0 max-skew=500 duration=3> & picture1 & audio1 </before>
    <while delay1=0 delay2=0 max-skew=80> & audio1 & video1 </while>
    <before delay=0 max-skew=500> & audio1 & picture2 </before>
    <before delay=0 max-skew=500 duration=2> & picture2 & movie1 </before>
    <before delay=0 max-skew=500> & movie1 & picture1 </before>
    </sequences>>
</package>
```

ART UNIT/CLASS

FIG.23

```
<package>
  <title format=DVL version=2.0>
    <cover> Authentication </cover>
    <name>"Authentication FOO Movie Services" </name>
    <sort> VOUCHER <minor-sort> AUTHNTICATION </minor-sort> </sort>
    <structure>
     <encrypted scheme=RSA key=#87654321098765 key-sort=open>
      <content-attributes>
        <user> Japan Taro </user>
        <account> #55443322 </sccount>
        <age> 25 </age>
        <data> 9 August 1997 </data>
        <time> 19:45 JST </time>
        </content-attributes>
      <control-attributes>
        <settlement> charge
            <credit-card> VISA </credit-card>
            <card-number> 0123 4567 8901 2345 </card-number>
            <holder> Japan Taro </holder>
            <expires> June 1999 </expires>
            </settlement>
        </control-attributes>
      <sequences>
        <text>
            <certification> FOO Movie Customers </certification>
            <name> "FOO Movie Services:Star Wars" </name>
            <reference> net-resource://movie-server/movie1 </reference>
            </text>
        </sequences>
      </encrypted>
    </structure>
  </title>
</package>
```

Entered - 25 Sept 1998

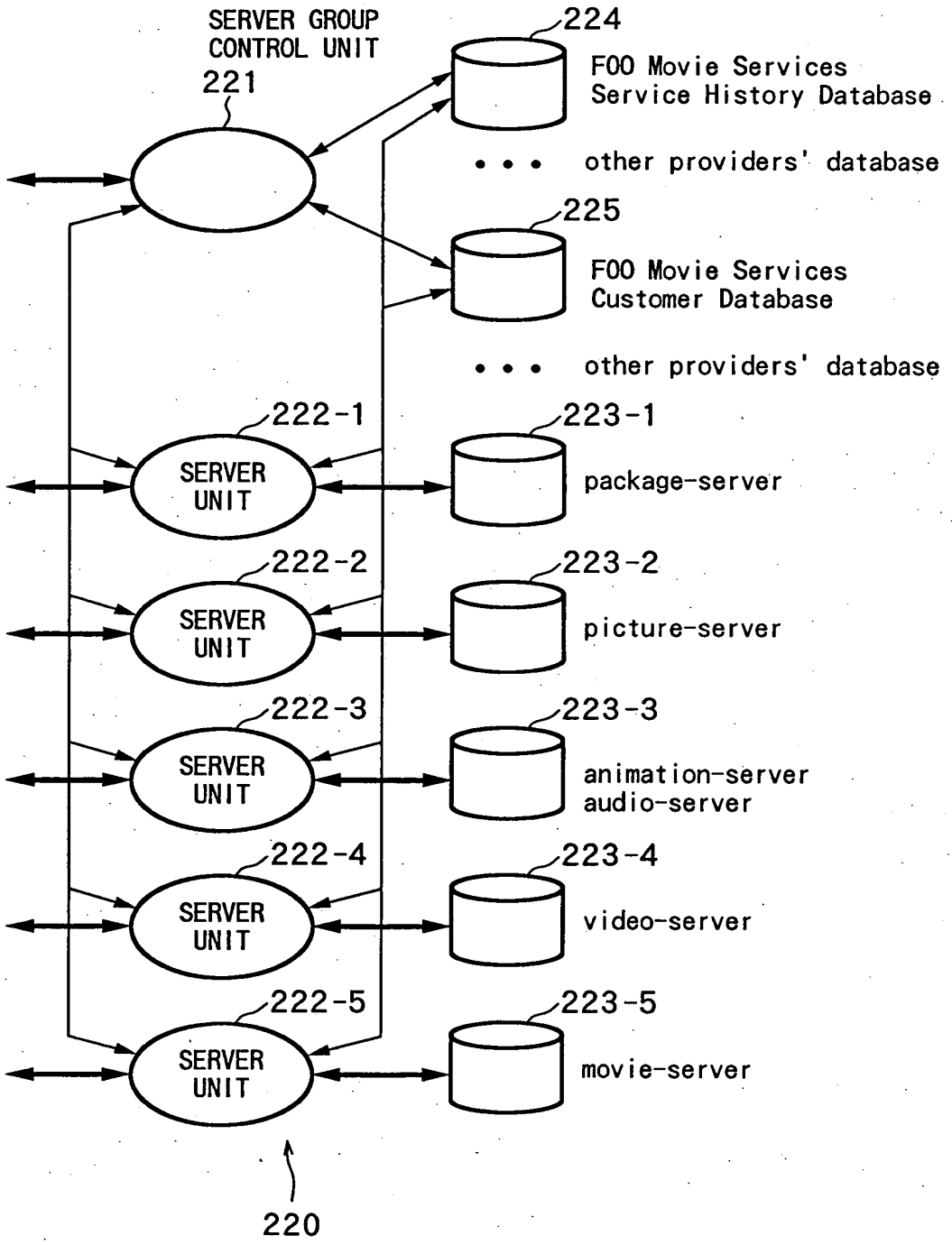
APPROVED BY ISS

FIG.24

```
<package>
  <title format=DVL version=2.0>
    <cover> Bill </cover>
    <name>"Bill: FOO Movie Services" </name>
    <sort> VOUCHER <minor-sort> BILL </minor-sort> </sort>
    <structure>
      <encrypted scheme=RSA key=#32109876543210 key-sort=open>
        <content-attributes>
          <sender> FOO Movie Services </sender>
          <data> 31 August 1997 </data>
          <time> 9:00 EDT </time>
          </content-attributes>
        <control-attributes>
          <billing currency=USD> 1,200 </billing>
          <settlement> money-transfer
              <bank> Bank Antarctica </bank>
              <branch> New York </branch>
              <holder> FOO Movie Services </holder>
              <account> 012345-678901 </account>
              </settlement>
          </control-attributes>
        <sequences>
          <text>
              <customer> BAR Food Services </customer>
              <content> Request for Monthly Payment </content>
              </text>
          </sequences>
        </encrypted>
      </structure>
    </title>
  </package>
```

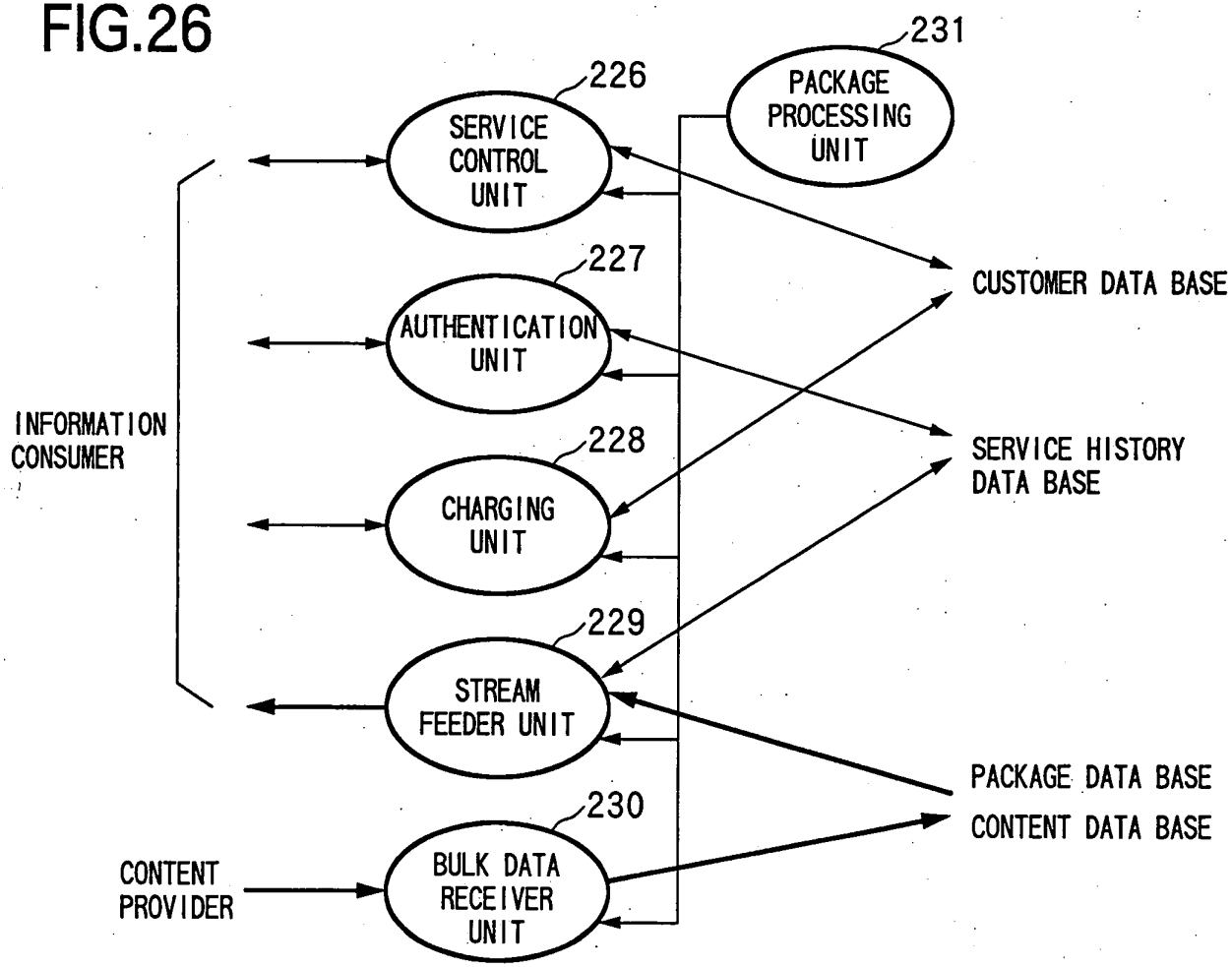
6,766,305 B2 Jul. 20, 2004

FIG.25


SERVER GROUP
CONTROL UNIT
221
224
FOO Movie Services
Service History Database
• • • other providers' database
225
FOO Movie Services
Customer Database
• • • other providers' database
222-1
SERVER
UNIT
223-1
package-server
222-2
SERVER
UNIT
223-2
picture-server
222-3
SERVER
UNIT
223-3
animation-server
audio-server
222-4
SERVER
UNIT
223-4
video-server
222-5
SERVER
UNIT
223-5
movie-server
220

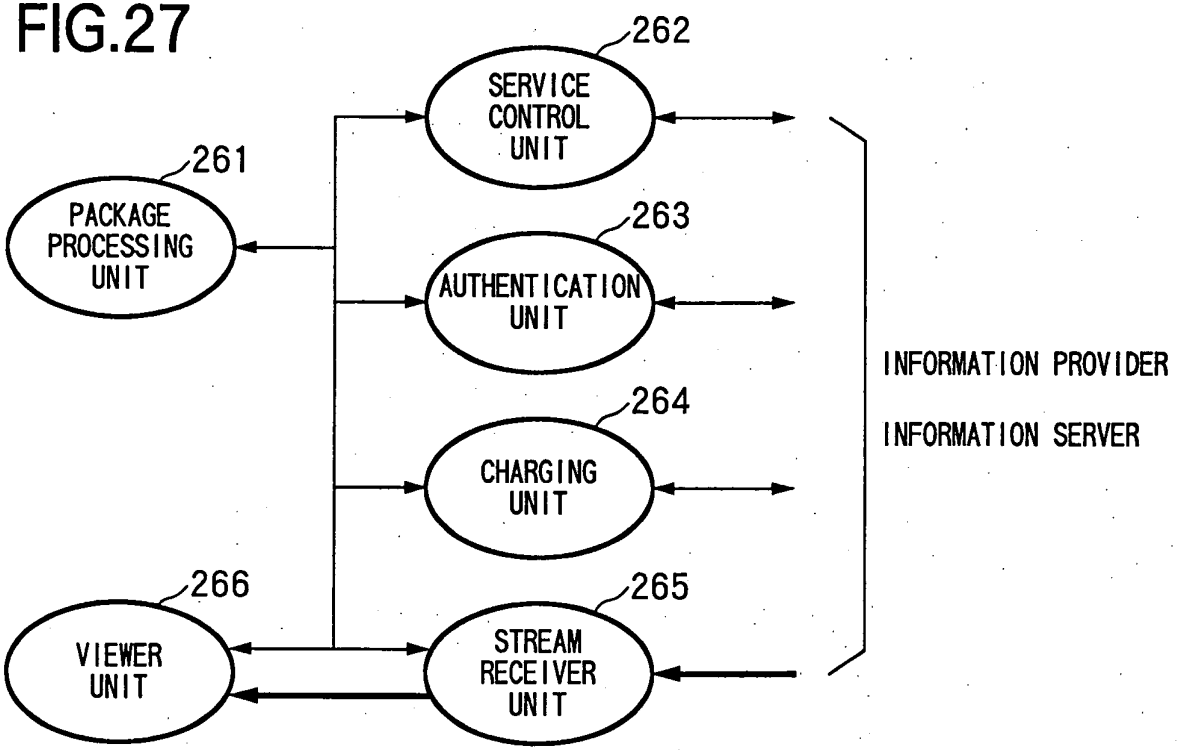
86h060 2838h160

FIG.26



86h060" 2288hF60

FIG.27



BY CLASS

FIG.28A

<tag>data</tag>

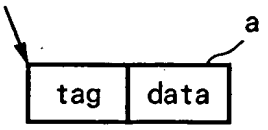


FIG.28B

<tag><tag1>data1</tag1>
• • • • •
<tagN>dataN</tagN>
</tag>

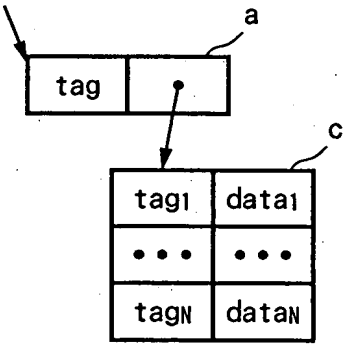


FIG.28C

<tag tag1=data1 · · · · tagM=dataM>
data
</tag>

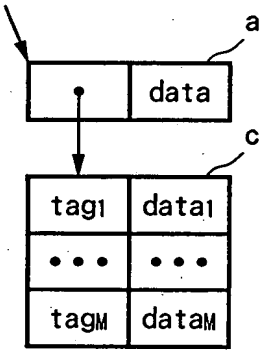


FIG.28D

<tag tag_1^1=$data_1^1$ · · · · tag_M^1=$data_M^1$>
<tag_1^2>$data_1^2$</tag_1^2>
• • • • •
<tag_N^2>$data_N^2$</tag_N^2>
</tag>

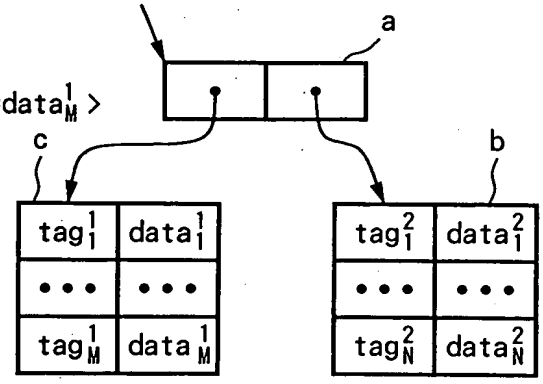
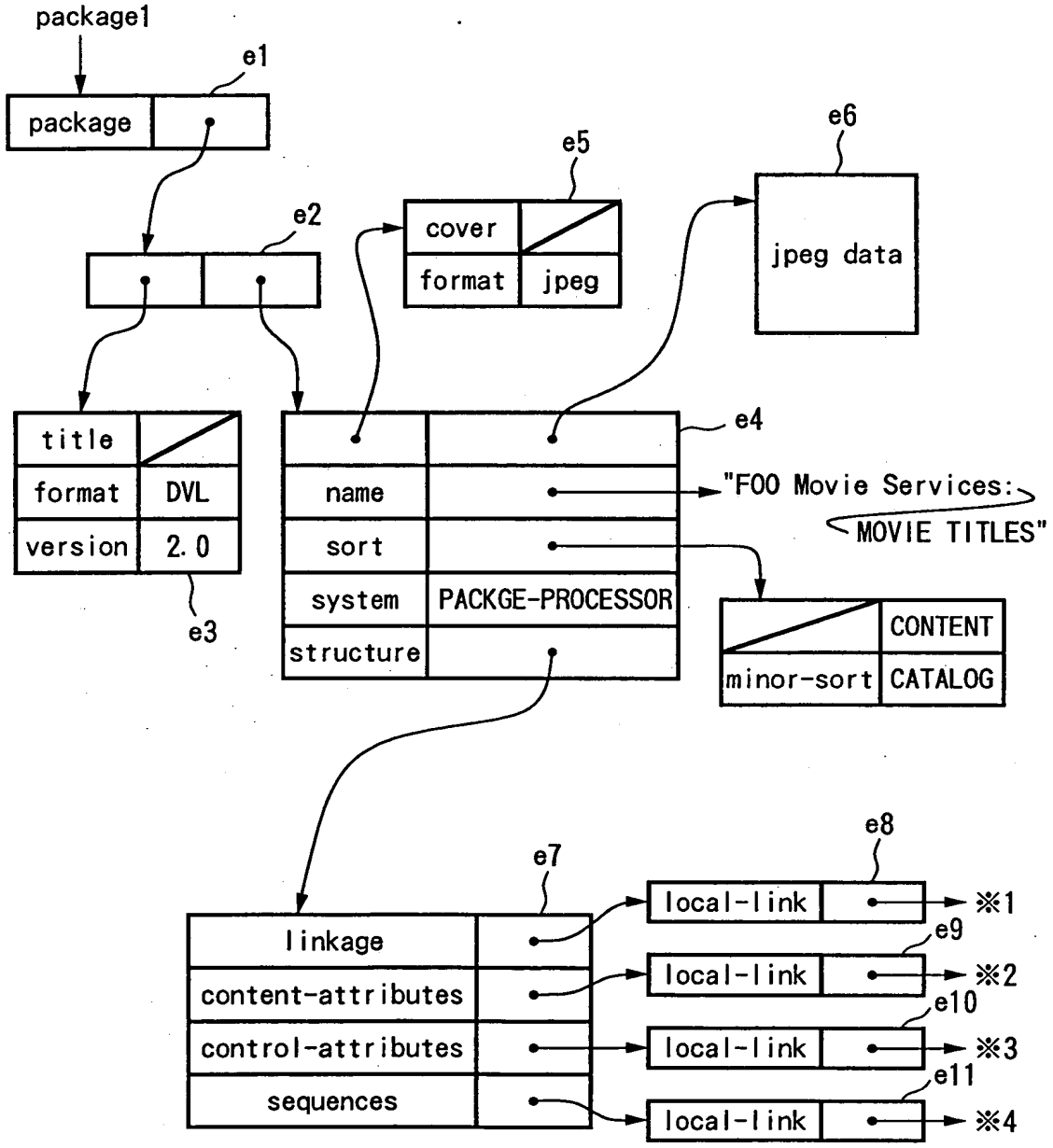
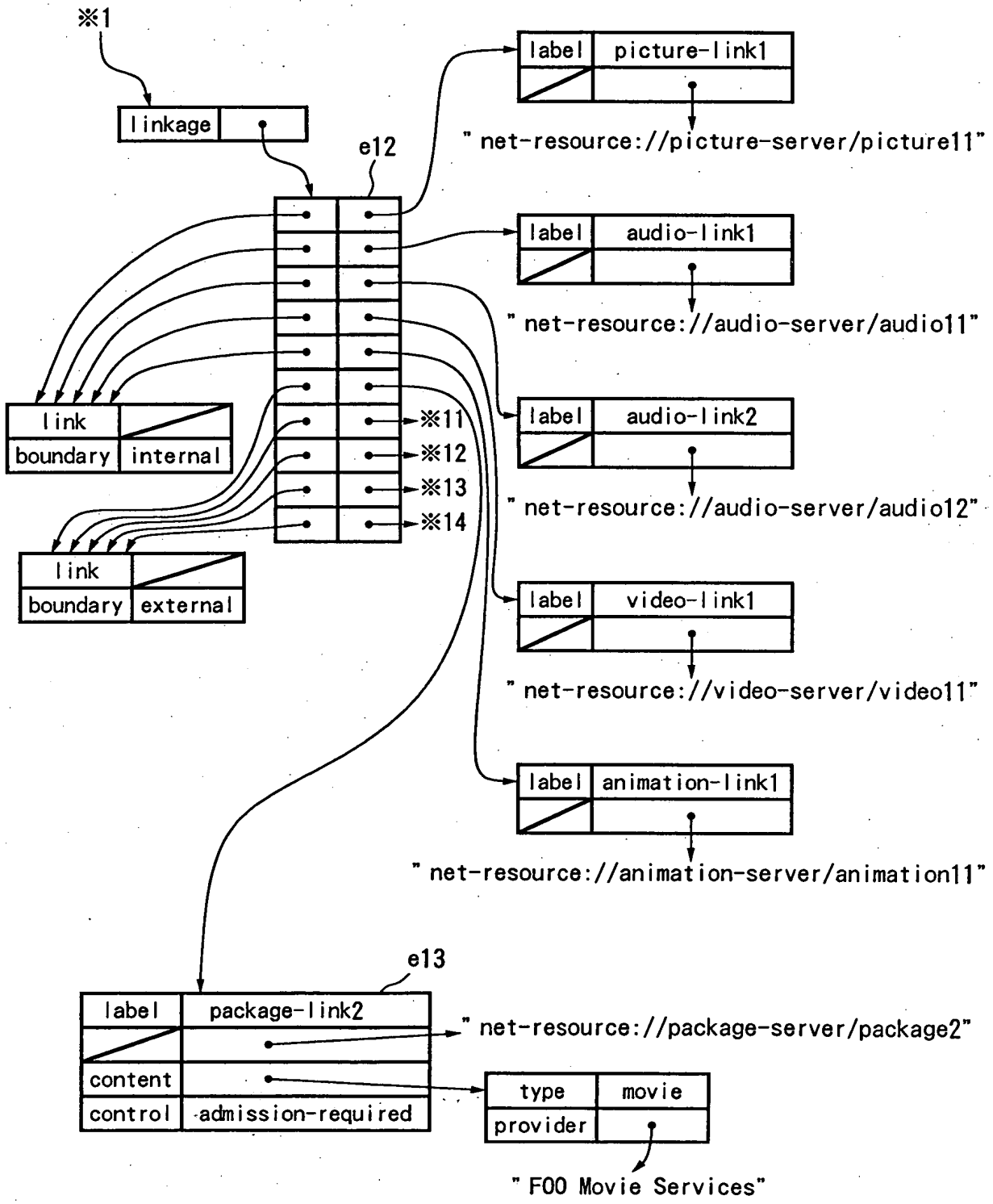


FIG.29


package1
e1
package
e2
e5
cover
format
jpeg
e6
jpeg data
title
format
DVL
version
2.0
e3
e4
name
"FOO Movie Services: MOVIE TITLES"
sort
system
PACKGE-PROCESSOR
structure
CONTENT
minor-sort
CATALOG
e7
e8
linkage
content-attributes
control-attributes
sequences
local-link
※1
e9
local-link
※2
e10
local-link
※3
e11
local-link
※4

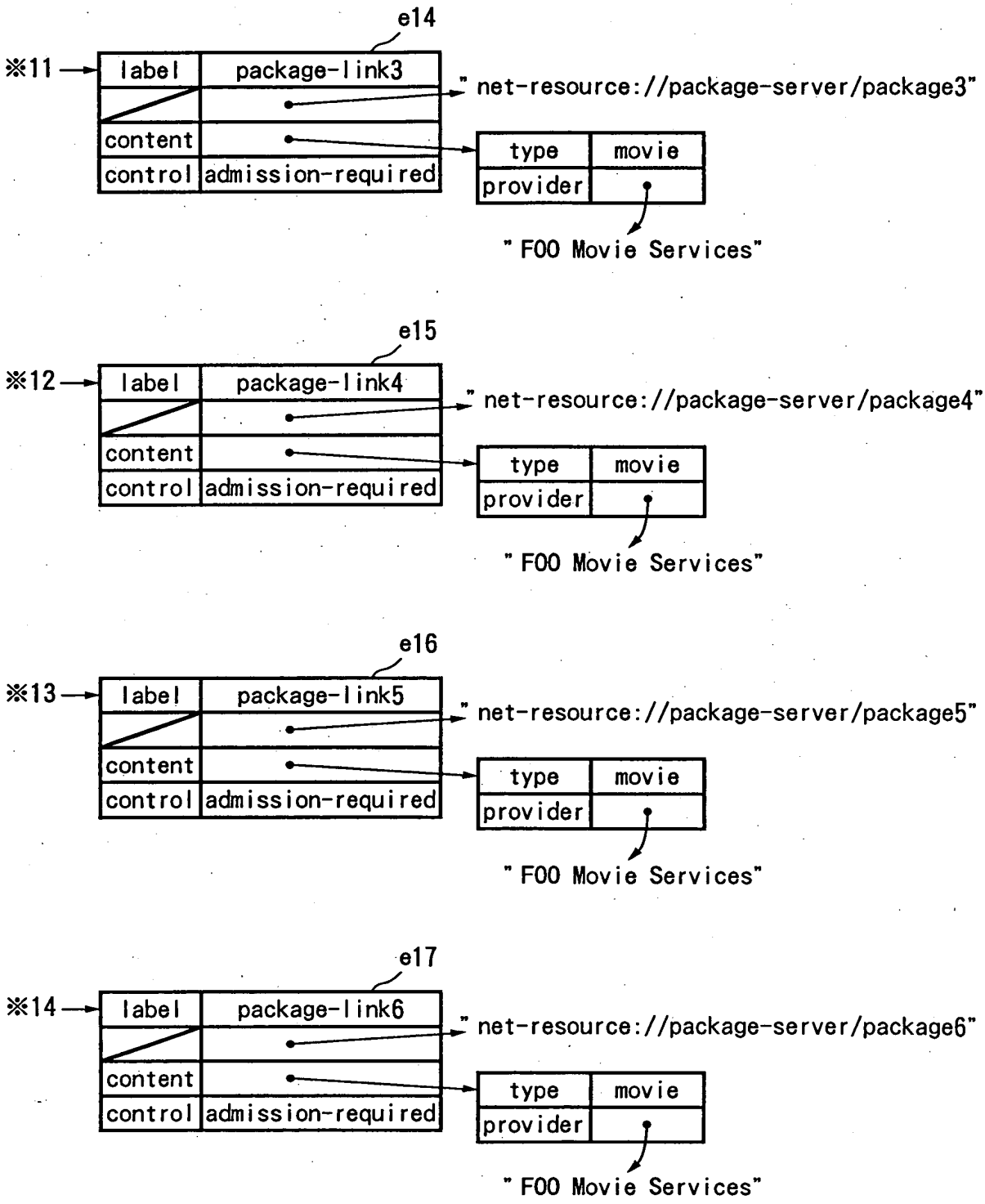
BY

FIG.30


※1
linkage
e12
label
picture-link1
" net-resource://picture-server/picture11"
label
audio-link1
" net-resource://audio-server/audio11"
label
audio-link2
" net-resource://audio-server/audio12"
label
video-link1
" net-resource://video-server/video11"
label
animation-link1
" net-resource://animation-server/animation11"
link
boundary
internal
link
boundary
external
※11
※12
※13
※14
e13
label
package-link2
" net-resource://package-server/package2"
content
control
admission-required
type
movie
provider
" FOO Movie Services"

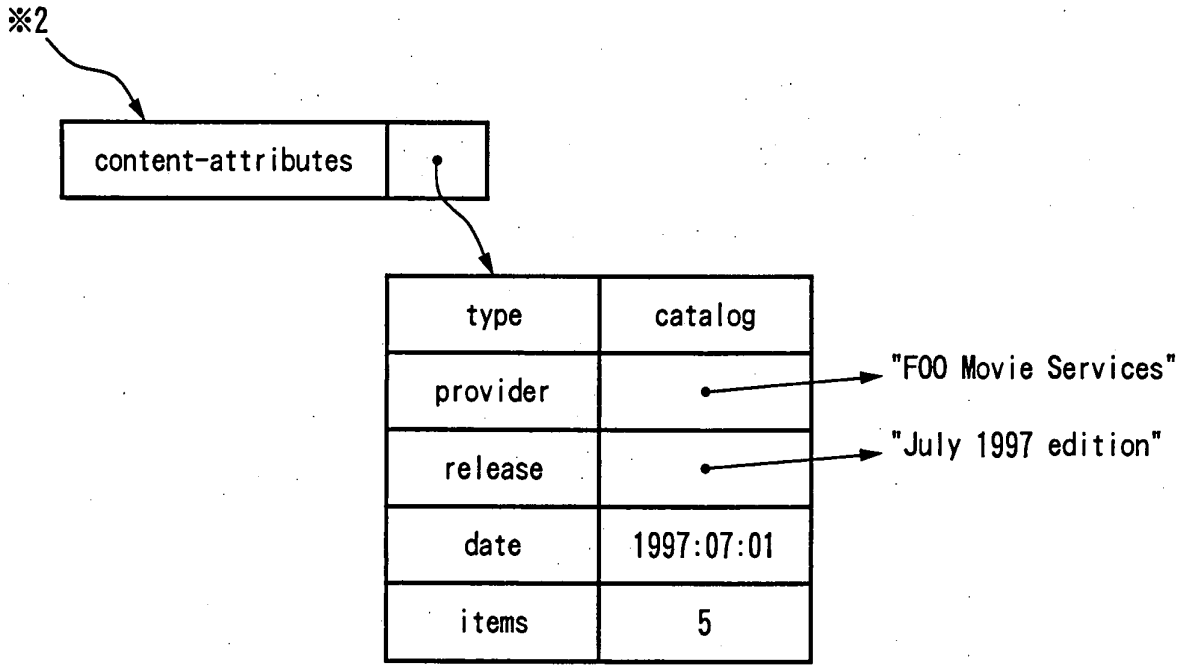
BY

FIG.31


e14
※11
label
package-link3
" net-resource://package-server/package3"
content
control
admission-required
type
movie
provider
" FOO Movie Services"
e15
※12
label
package-link4
" net-resource://package-server/package4"
content
control
admission-required
type
movie
provider
" FOO Movie Services"
e16
※13
label
package-link5
" net-resource://package-server/package5"
content
control
admission-required
type
movie
provider
" FOO Movie Services"
e17
※14
label
package-link6
" net-resource://package-server/package6"
content
control
admission-required
type
movie
provider
" FOO Movie Services"

96h060 2E98hF60

FIG.32



86h060 25884160

FIG.33

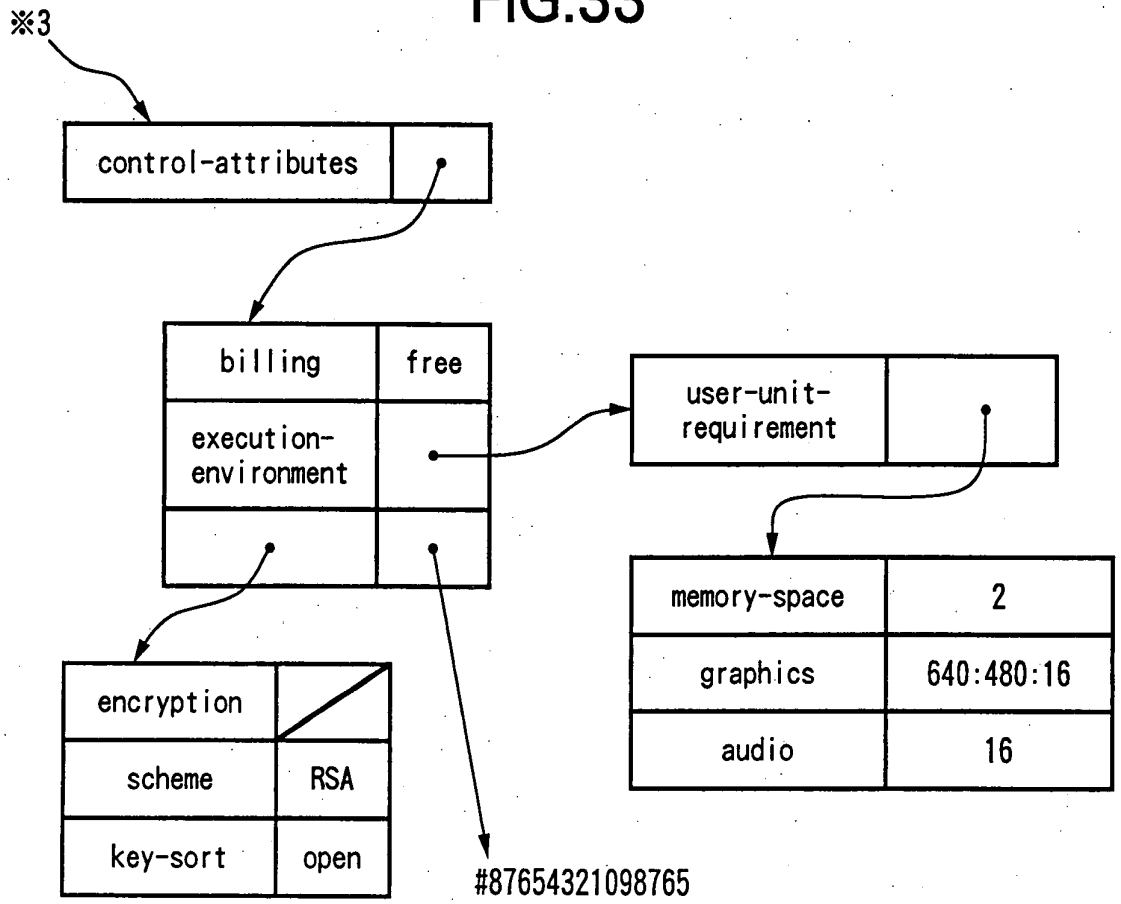


FIG.34

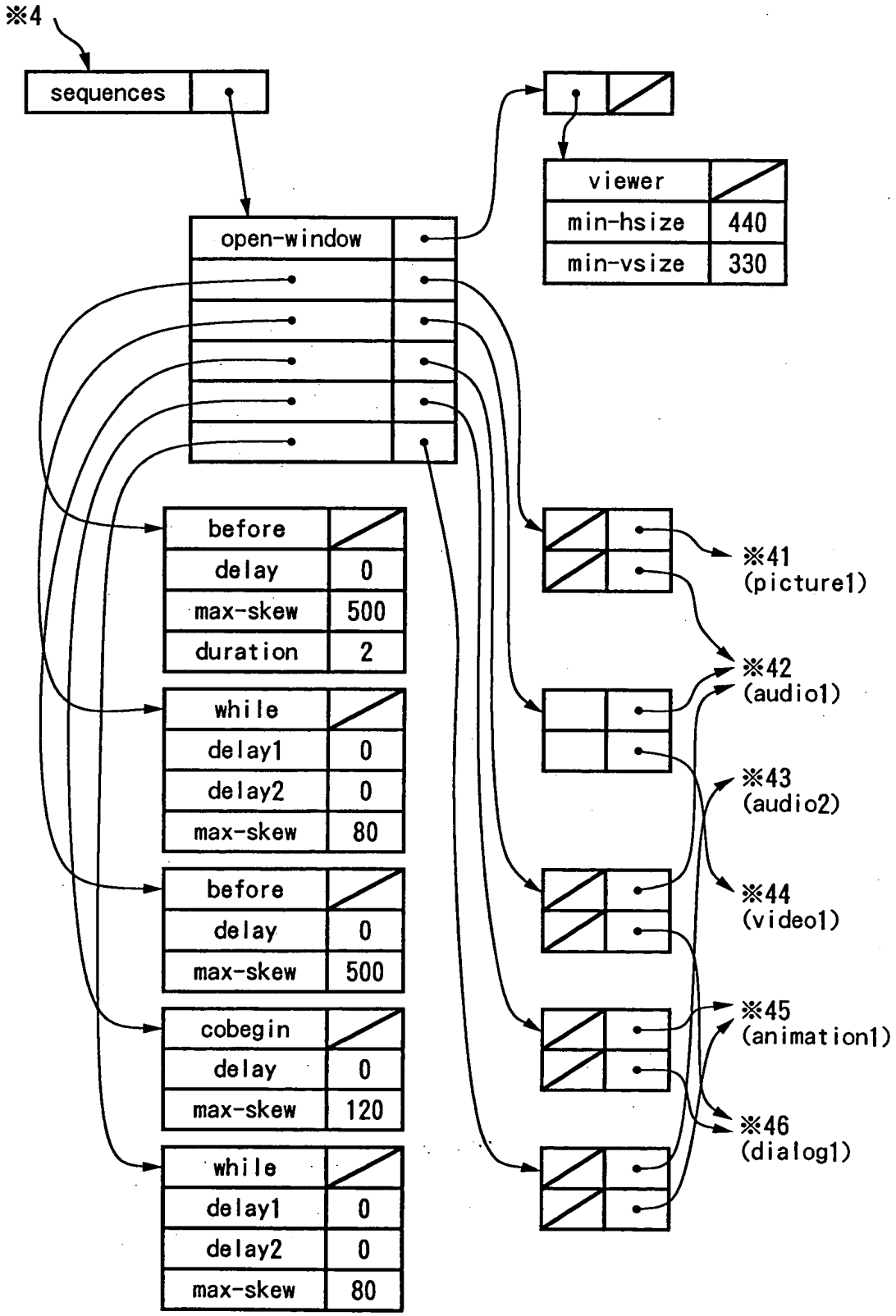
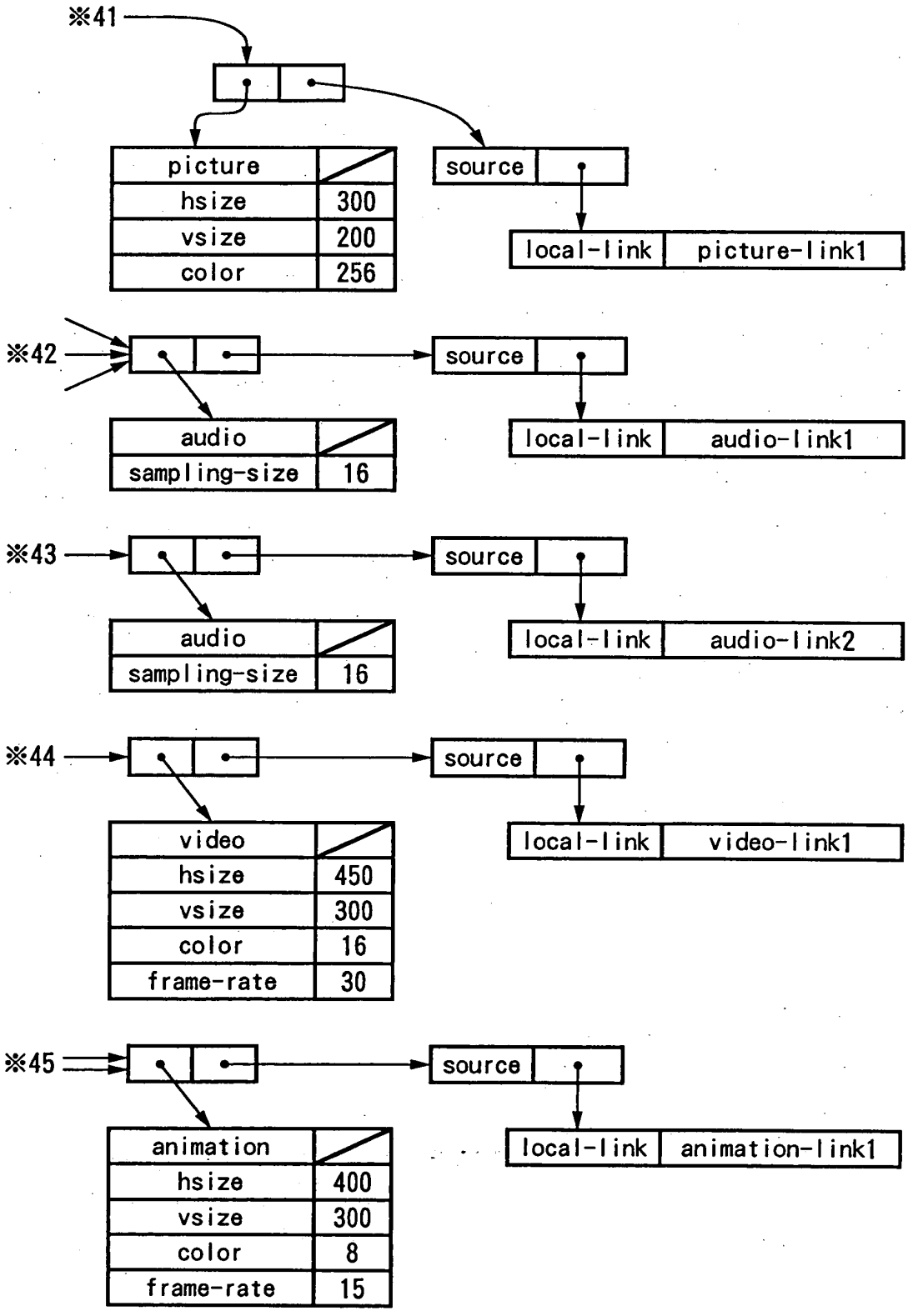
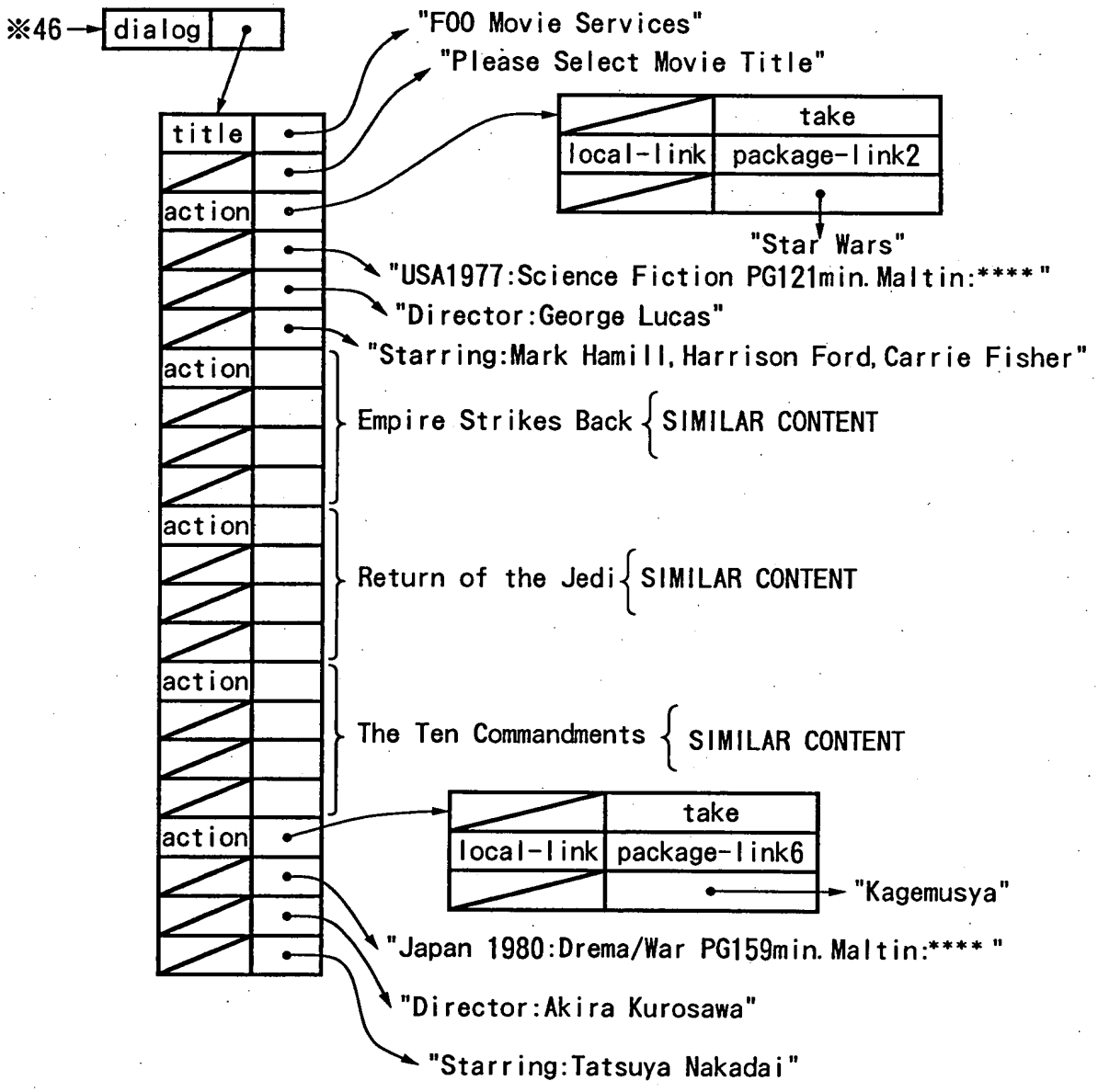

※4
sequences
open-window
viewer
min-hsize
440
min-vsize
330
before
delay
0
max-skew
500
duration
2
while
delay1
0
delay2
0
max-skew
80
before
delay
0
max-skew
500
cobegin
delay
0
max-skew
120
while
delay1
0
delay2
0
max-skew
80
※41
(picture1)
※42
(audio1)
※43
(audio2)
※44
(video1)
※45
(animation1)
※46
(dialog1)

FIG.35


※41
picture
hsize 300
vsize 200
color 256
source
local-link picture-link1
※42
audio
sampling-size 16
source
local-link audio-link1
※43
audio
sampling-size 16
source
local-link audio-link2
※44
video
hsize 450
vsize 300
color 16
frame-rate 30
source
local-link video-link1
※45
animation
hsize 400
vsize 300
color 8
frame-rate 15
source
local-link animation-link1

PATENT OFFICE JAPANESE GOVERNMENT

FIG.36



86h060" 2686hF60

FIG.37

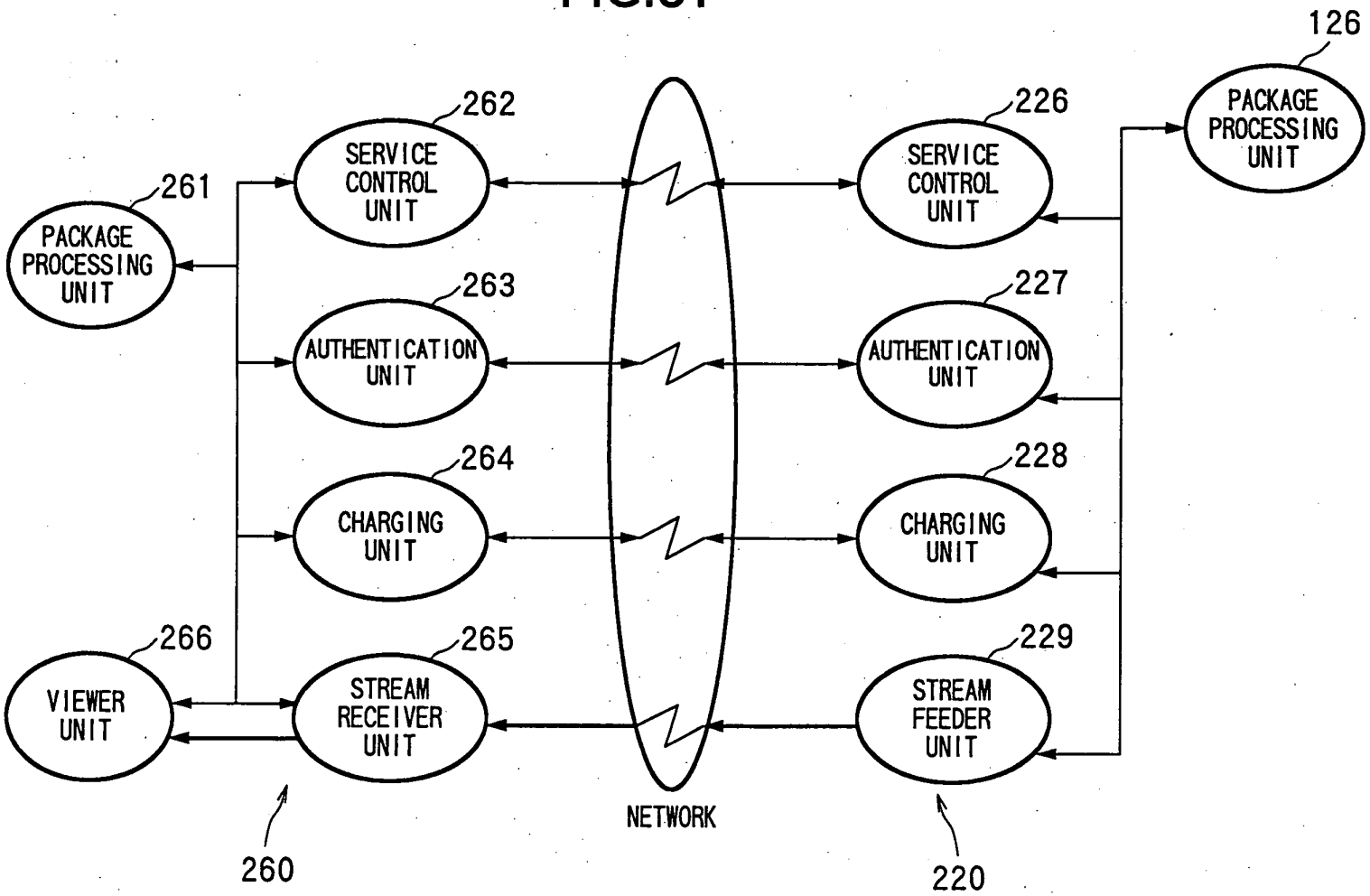


FIG.38

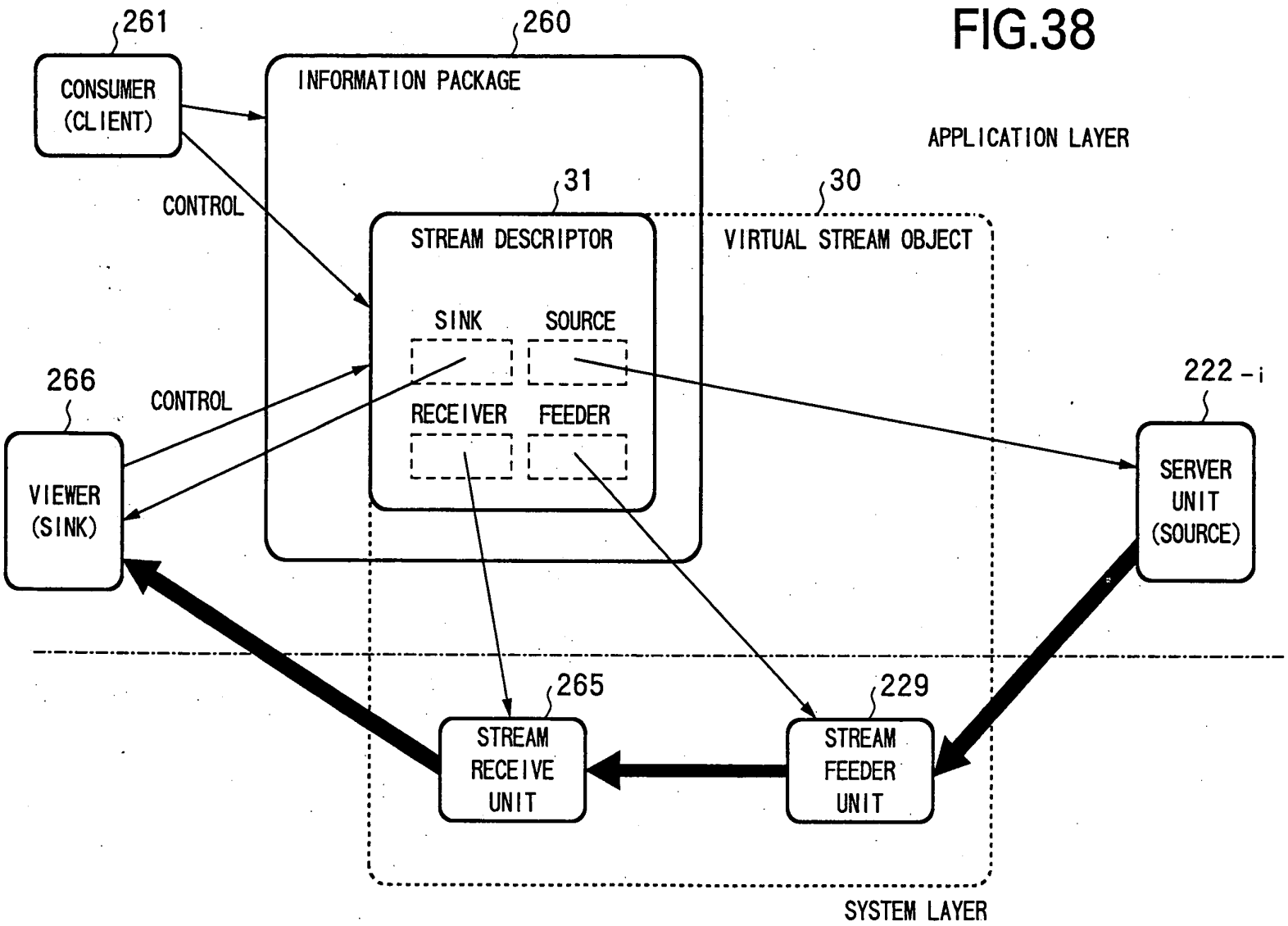

261
CONSUMER (CLIENT)
260
INFORMATION PACKAGE
APPLICATION LAYER
CONTROL
31
STREAM DESCRIPTOR
30
VIRTUAL STREAM OBJECT
SINK
SOURCE
266
CONTROL
RECEIVER
FEEDER
222-i
VIEWER (SINK)
SERVER UNIT (SOURCE)
265
229
STREAM RECEIVE UNIT
STREAM FEEDER UNIT
SYSTEM LAYER

FIG.39

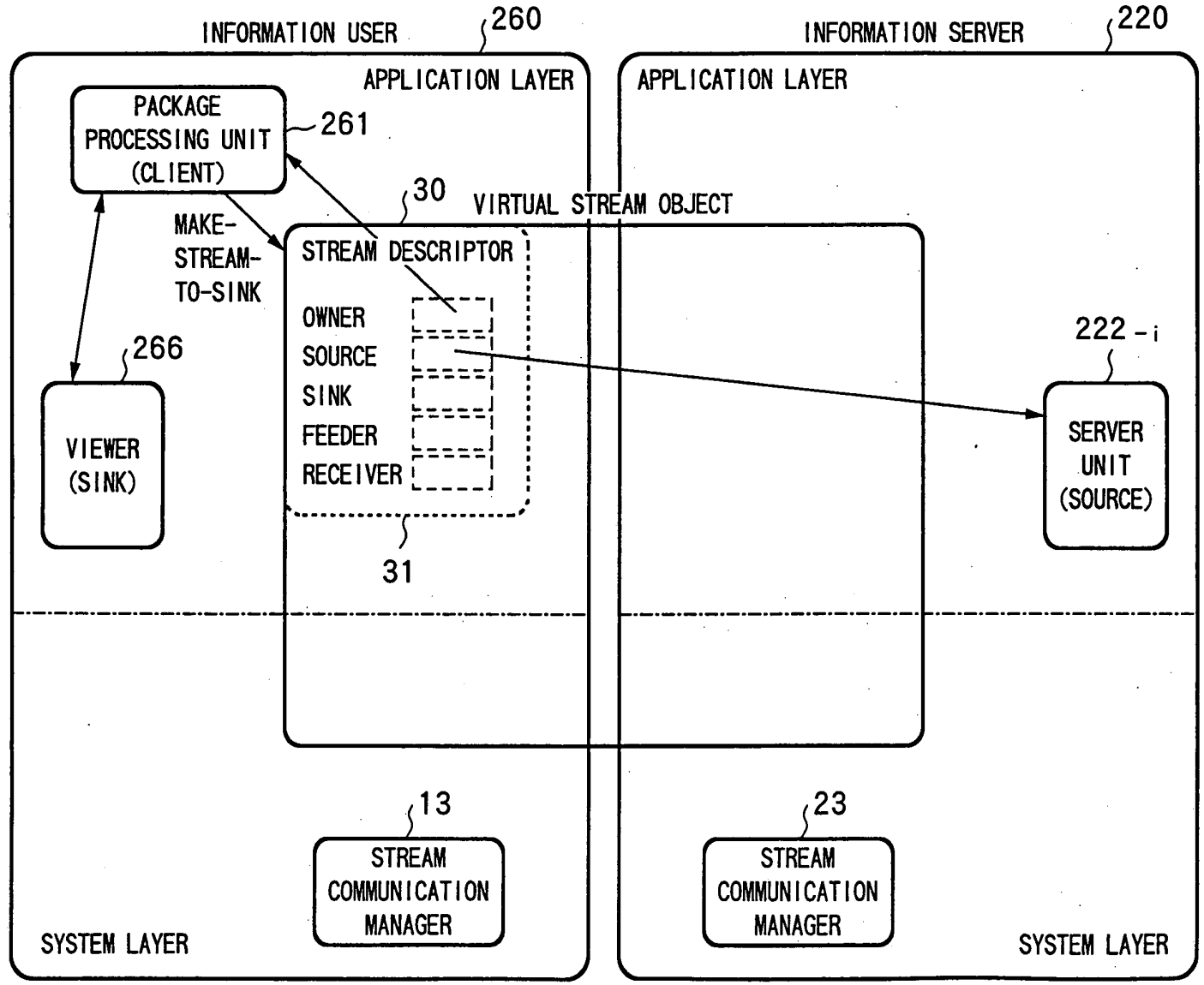
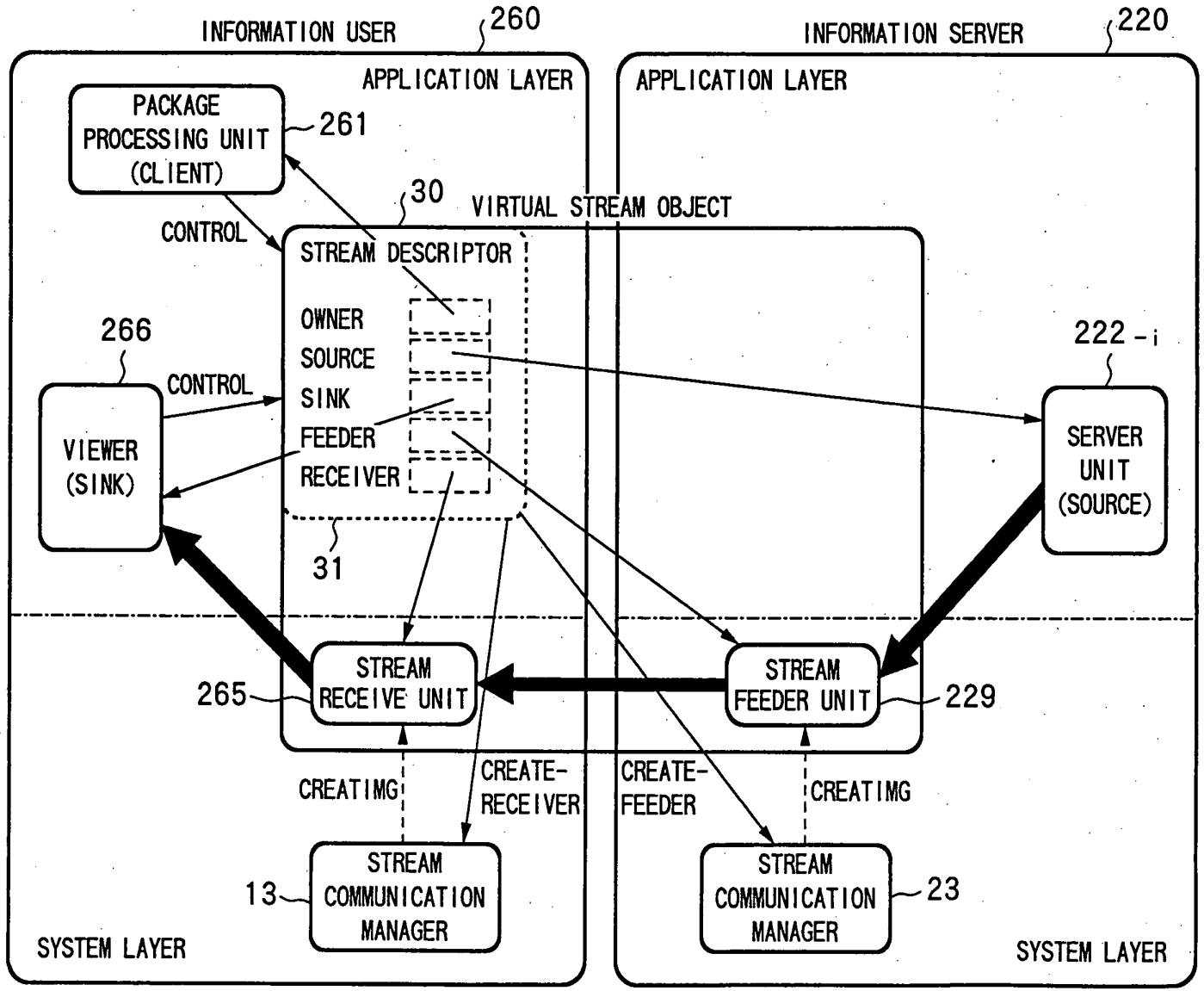

INFORMATION USER
260
APPLICATION LAYER
PACKAGE PROCESSING UNIT (CLIENT)
261
30
VIRTUAL STREAM OBJECT
MAKE-STREAM-TO-SINK
STREAM DESCRIPTOR
OWNER
SOURCE
SINK
FEEDER
RECEIVER
266
VIEWER (SINK)
31
222-i
SERVER UNIT (SOURCE)
INFORMATION SERVER
220
APPLICATION LAYER
13
STREAM COMMUNICATION MANAGER
23
STREAM COMMUNICATION MANAGER
SYSTEM LAYER
SYSTEM LAYER

FIG.40


INFORMATION USER
260
APPLICATION LAYER
PACKAGE PROCESSING UNIT (CLIENT)
261
CONTROL
30
VIRTUAL STREAM OBJECT
STREAM DESCRIPTOR
OWNER
SOURCE
SINK
FEEDER
RECEIVER
31
266
CONTROL
VIEWER (SINK)
INFORMATION SERVER
220
APPLICATION LAYER
222-i
SERVER UNIT (SOURCE)
STREAM RECEIVE UNIT
265
STREAM FEEDER UNIT
229
CREATIMG
CREATE-RECEIVER
CREATE-FEEDER
CREATIMG
STREAM COMMUNICATION MANAGER
13
STREAM COMMUNICATION MANAGER
23
SYSTEM LAYER
SYSTEM LAYER

BY

FIG.41

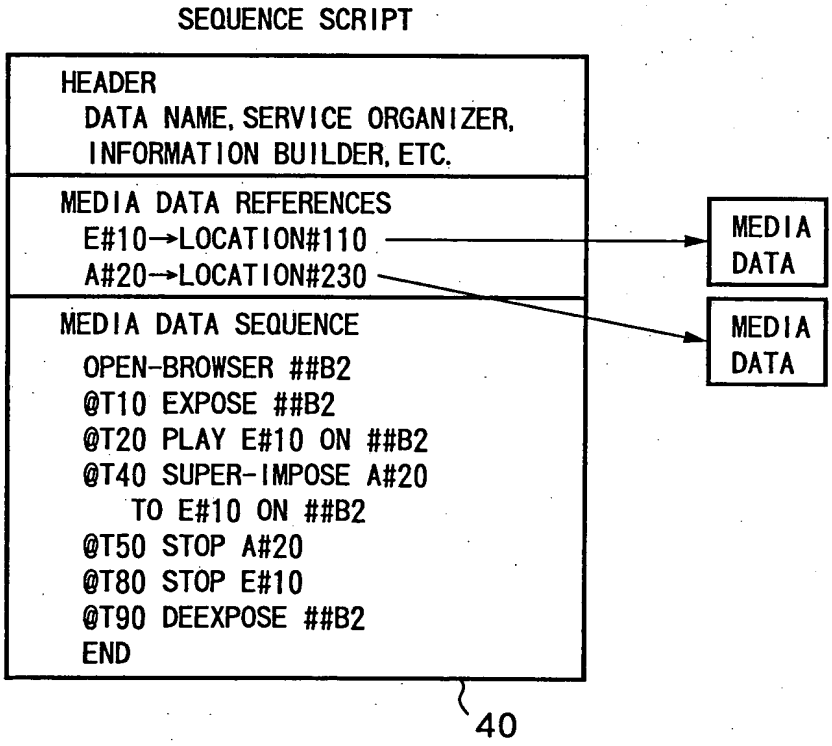

SEQUENCE SCRIPT
HEADER
DATA NAME, SERVICE ORGANIZER,
INFORMATION BUILDER, ETC.
MEDIA DATA REFERENCES
E#10→LOCATION#110
A#20→LOCATION#230
MEDIA DATA SEQUENCE
OPEN-BROWSER ##B2
@T10 EXPOSE ##B2
@T20 PLAY E#10 ON ##B2
@T40 SUPER-IMPOSE A#20
TO E#10 ON ##B2
@T50 STOP A#20
@T80 STOP E#10
@T90 DEEXPOSE ##B2
END
MEDIA DATA
MEDIA DATA
40

FIG.42

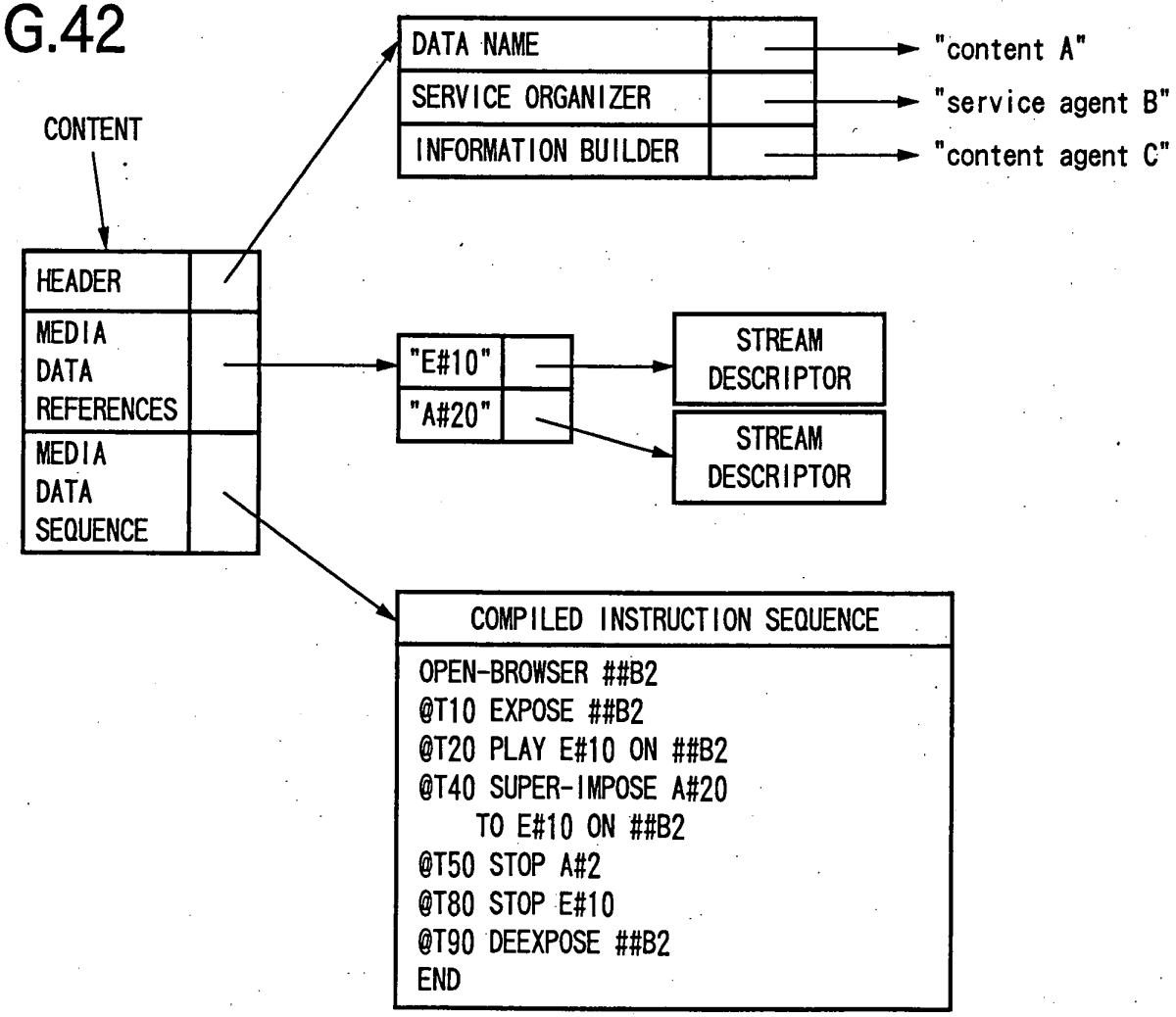

CONTENT
HEADER
MEDIA DATA REFERENCES
MEDIA DATA SEQUENCE
DATA NAME
SERVICE ORGANIZER
INFORMATION BUILDER
"content A"
"service agent B"
"content agent C"
"E#10"
"A#20"
STREAM DESCRIPTOR
STREAM DESCRIPTOR
COMPILED INSTRUCTION SEQUENCE
OPEN-BROWSER ##B2
@T10 EXPOSE ##B2
@T20 PLAY E#10 ON ##B2
@T40 SUPER-IMPOSE A#20
TO E#10 ON ##B2
@T50 STOP A#2
@T80 STOP E#10
@T90 DEEXPOSE ##B2
END

FIG.43

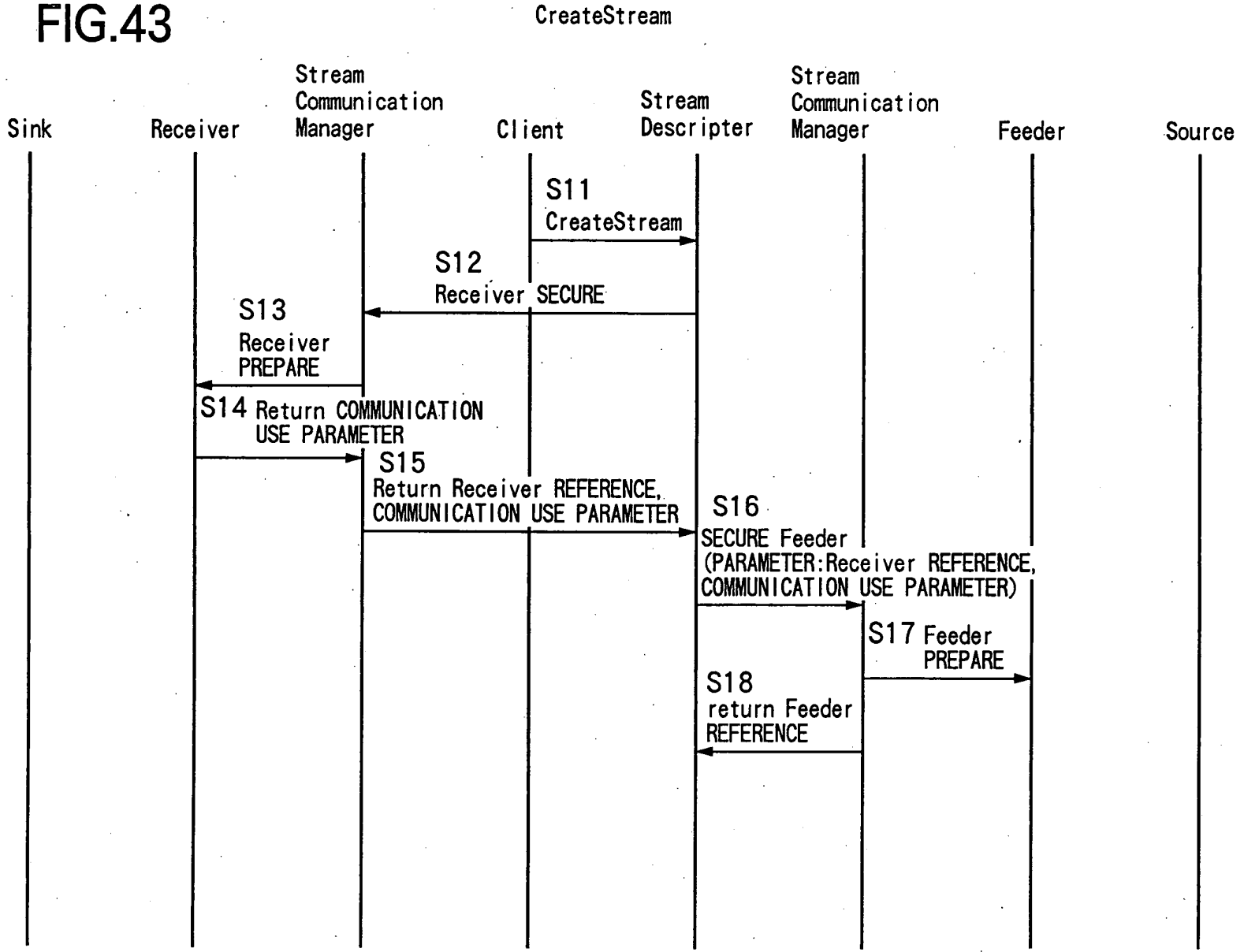

CreateStream
Sink
Receiver
Stream Communication Manager
Client
Stream Descripter
Stream Communication Manager
Feeder
Source
S11
CreateStream
S12
Receiver SECURE
S13
Receiver PREPARE
S14 Return COMMUNICATION USE PARAMETER
S15
Return Receiver REFERENCE, COMMUNICATION USE PARAMETER
S16
SECURE Feeder (PARAMETER:Receiver REFERENCE, COMMUNICATION USE PARAMETER)
S17 Feeder PREPARE
S18
return Feeder REFERENCE

FIG.44

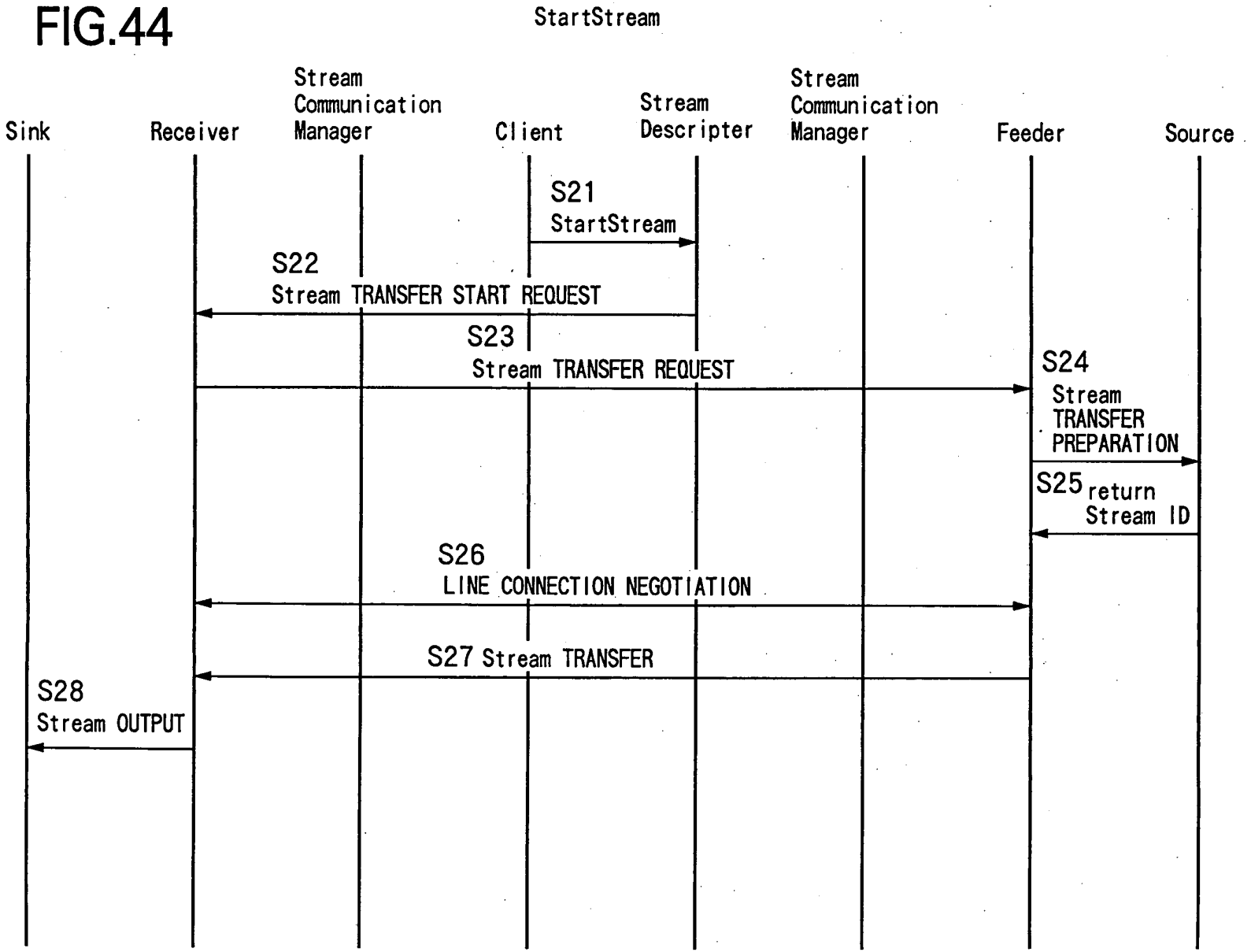

StartStream
Sink
Receiver
Stream Communication Manager
Client
Stream Descripter
Stream Communication Manager
Feeder
Source
S21
StartStream
S22
Stream TRANSFER START REQUEST
S23
Stream TRANSFER REQUEST
S24
Stream TRANSFER PREPARATION
S25 return Stream ID
S26
LINE CONNECTION NEGOTIATION
S27 Stream TRANSFER
S28
Stream OUTPUT

FIG.45A

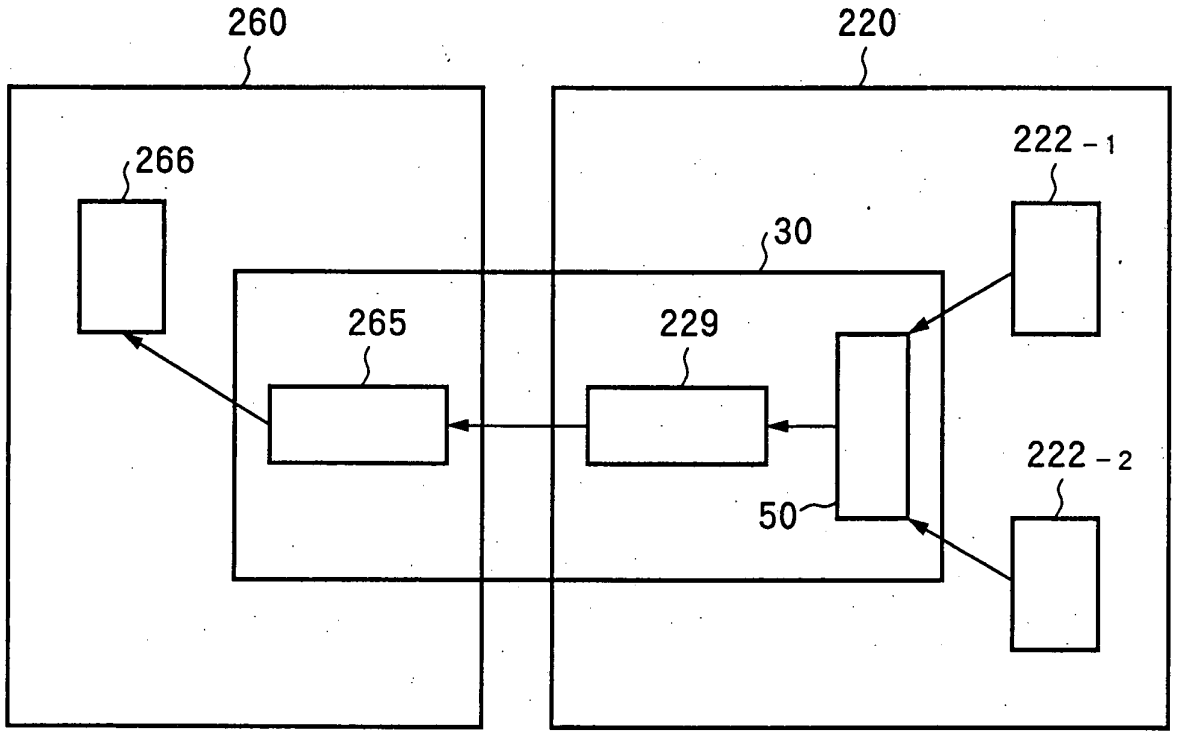


FIG.45B

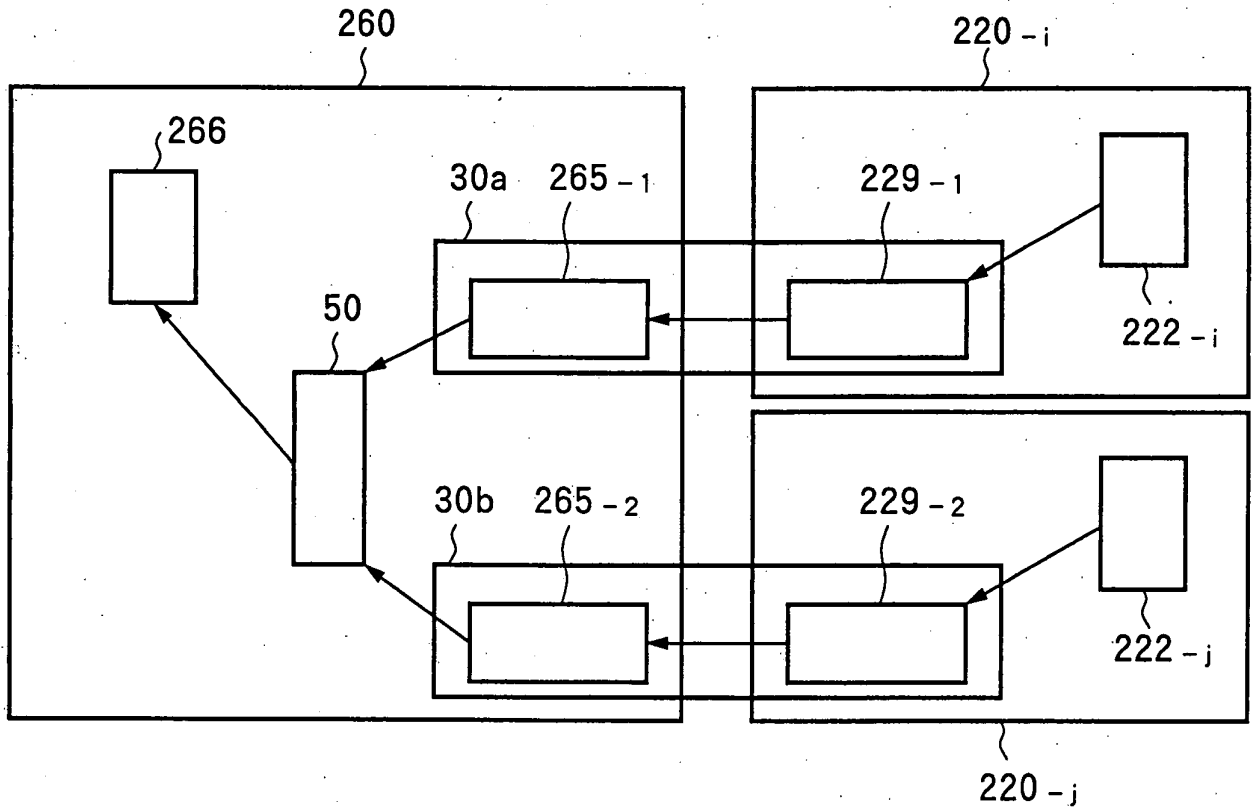
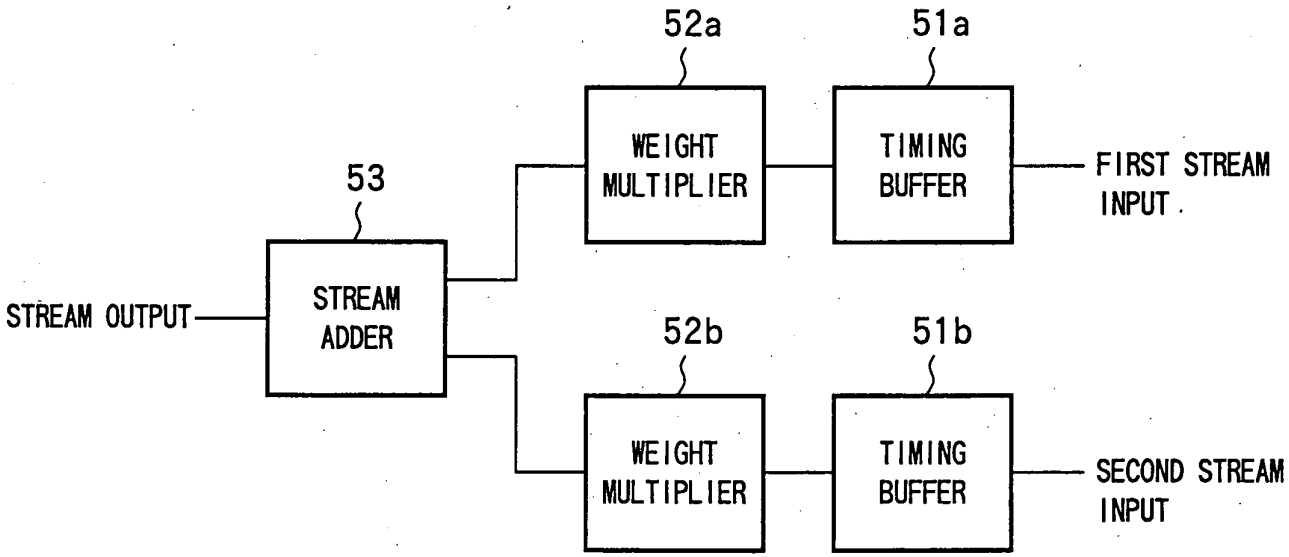


FIG.46


52a
51a
53
WEIGHT MULTIPLIER
TIMING BUFFER
FIRST STREAM INPUT
STREAM OUTPUT
STREAM ADDER
52b
51b
WEIGHT MULTIPLIER
TIMING BUFFER
SECOND STREAM INPUT
50

86h060" 2E88hT60

FIG.47A

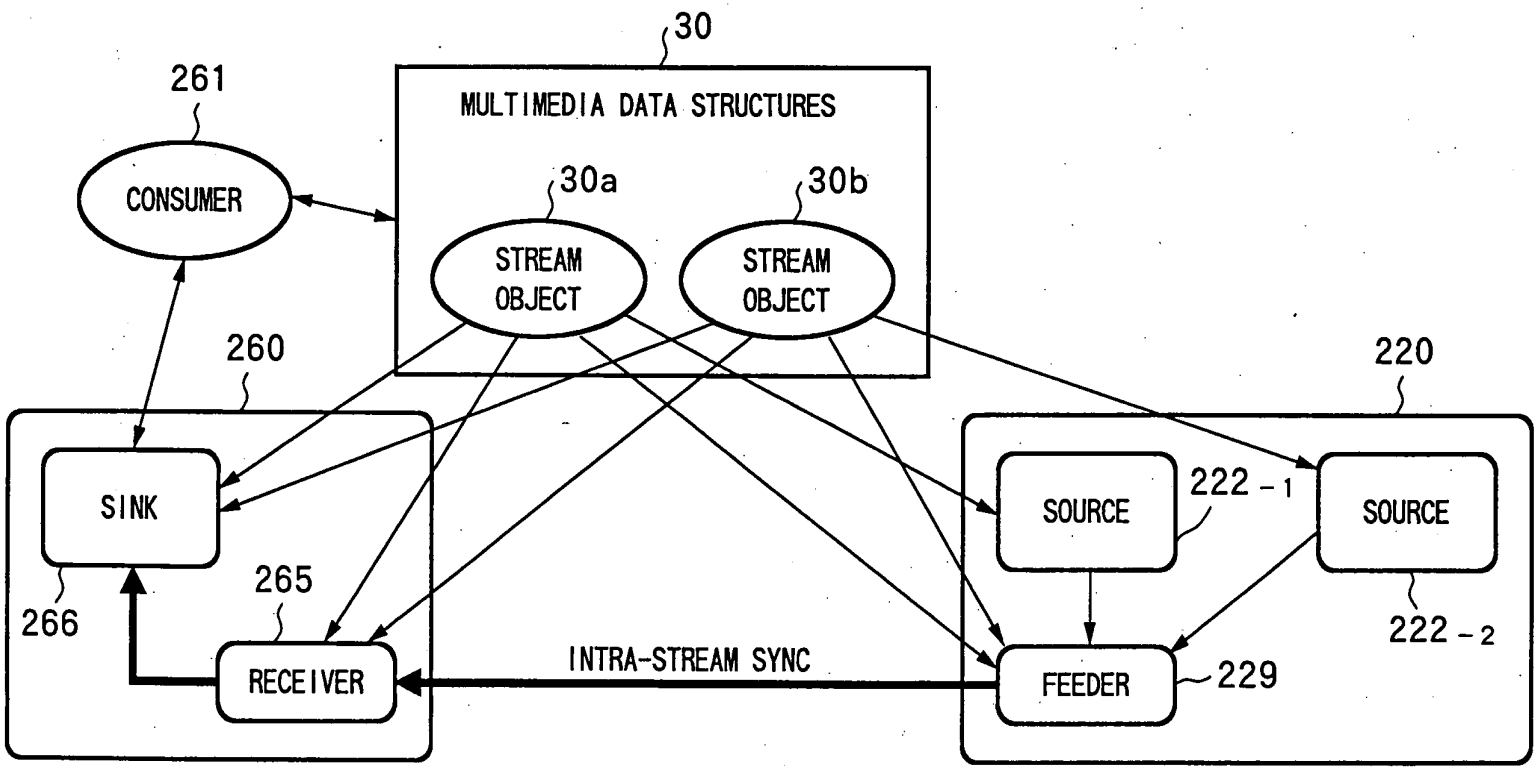


FIG.47B

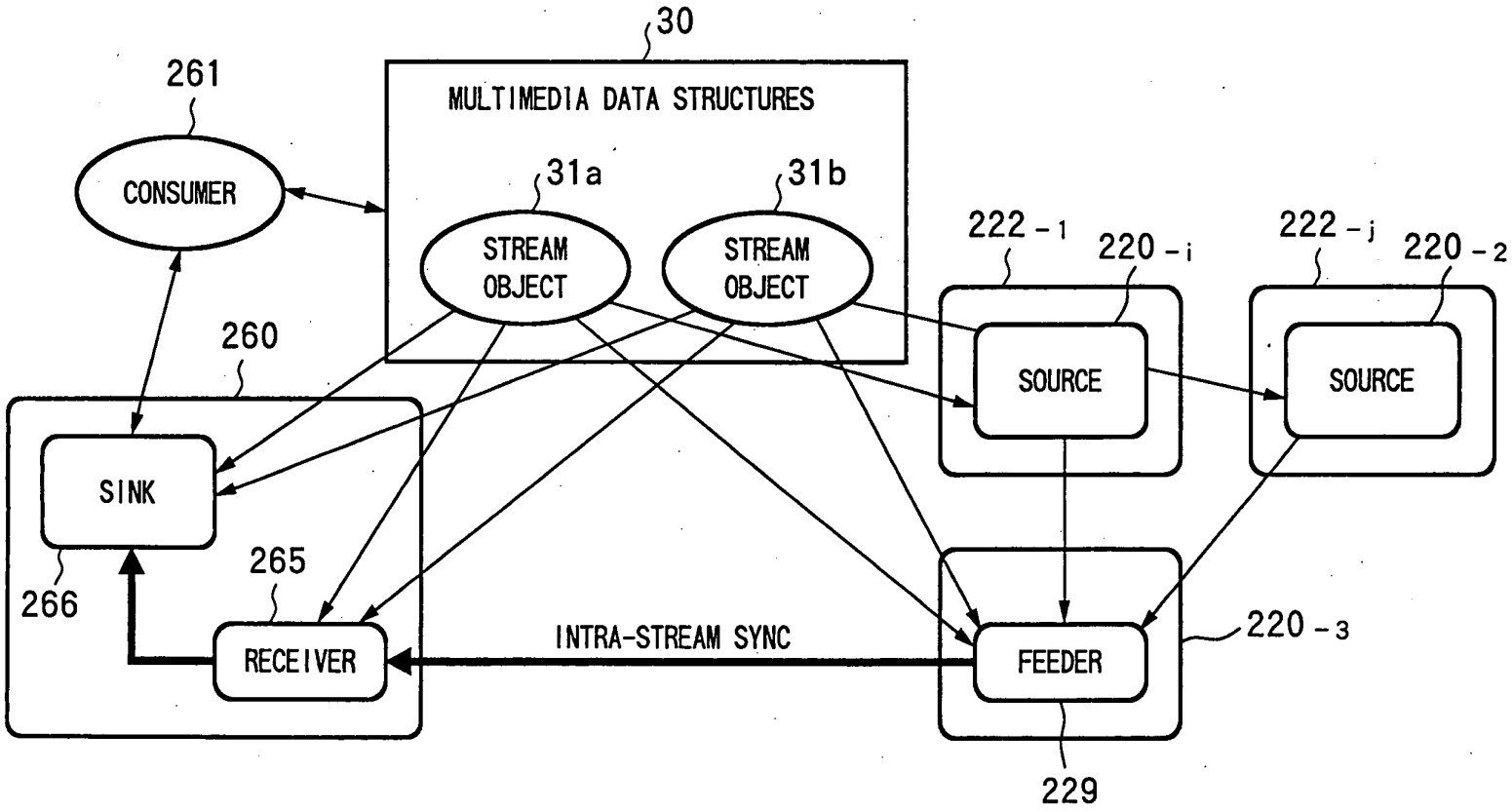

30
MULTIMEDIA DATA STRUCTURES
261
CONSUMER
31a
31b
STREAM OBJECT
STREAM OBJECT
222 - 1
220 - i
222 - j
220 - 2
SOURCE
SOURCE
260
SINK
265
266
RECEIVER
INTRA-STREAM SYNC
FEEDER
220 - 3
229

FIG.48

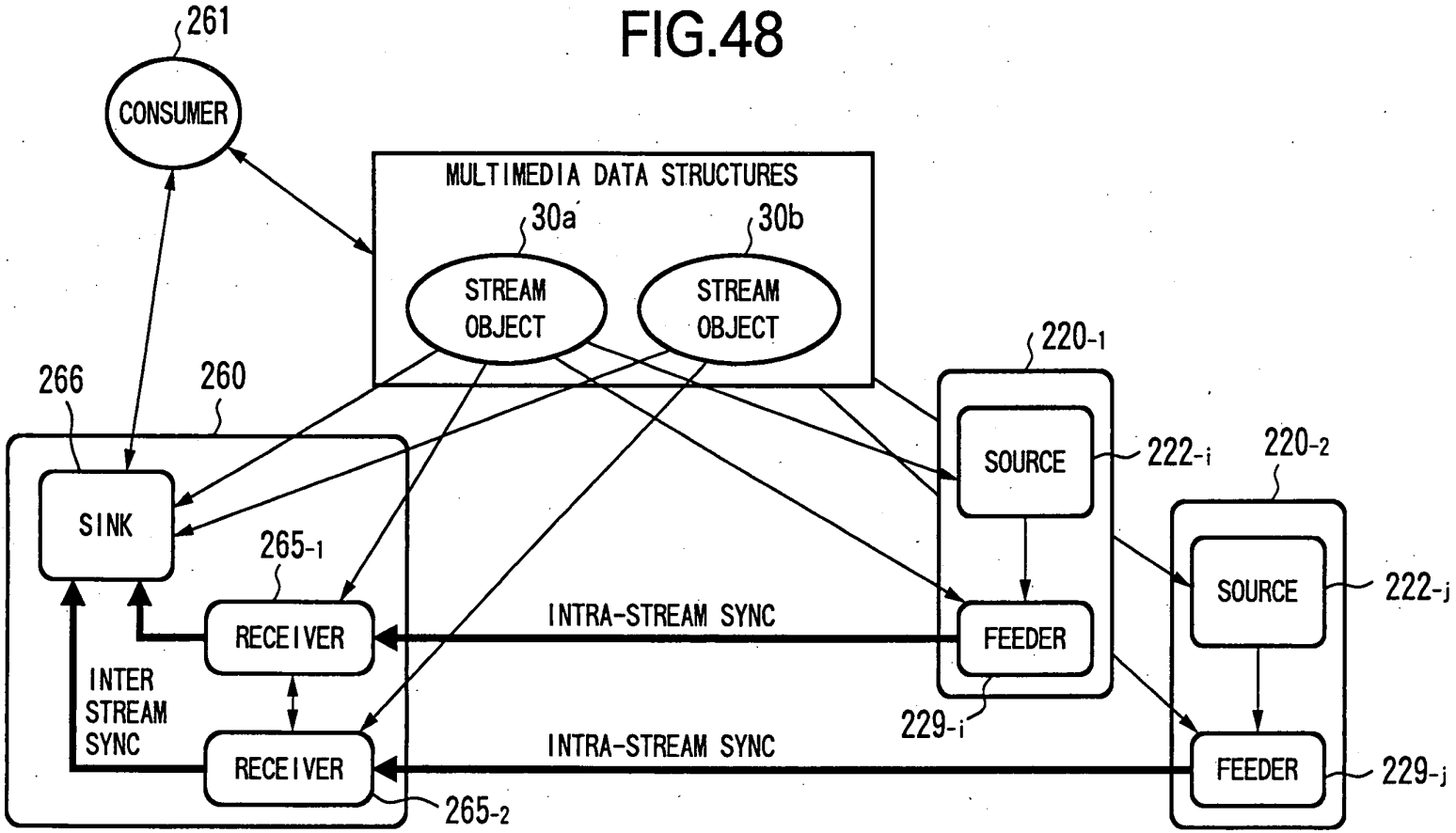
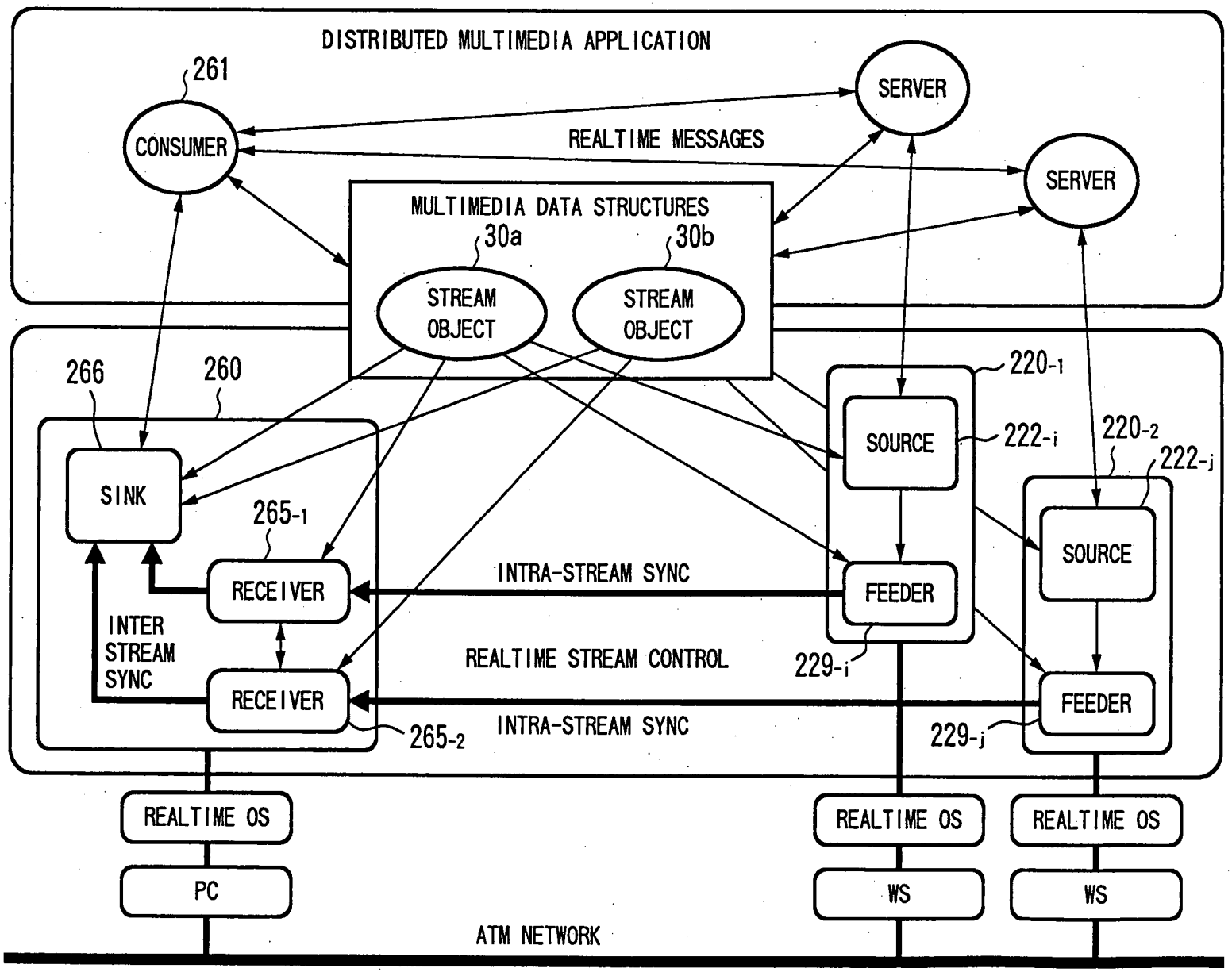

261
CONSUMER
MULTIMEDIA DATA STRUCTURES
30a
30b
STREAM OBJECT
STREAM OBJECT
220-1
266
260
SOURCE
222-i
220-2
SINK
265-1
SOURCE
222-j
INTRA-STREAM SYNC
RECEIVER
FEEDER
INTER STREAM SYNC
229-i
INTRA-STREAM SYNC
RECEIVER
FEEDER
229-j
265-2

FIG.49


DISTRIBUTED MULTIMEDIA APPLICATION
261
CONSUMER
SERVER
REALTIME MESSAGES
SERVER
MULTIMEDIA DATA STRUCTURES
30a
30b
STREAM OBJECT
STREAM OBJECT
266
260
220-1
SOURCE
222-i
220-2
222-j
SINK
265-1
SOURCE
INTRA-STREAM SYNC
RECEIVER
FEEDER
INTER STREAM SYNC
REALTIME STREAM CONTROL
229-i
RECEIVER
FEEDER
INTRA-STREAM SYNC
265-2
229-j
REALTIME OS
REALTIME OS
REALTIME OS
PC
WS
WS
ATM NETWORK

86h060" 2E88hT60

FIG.50

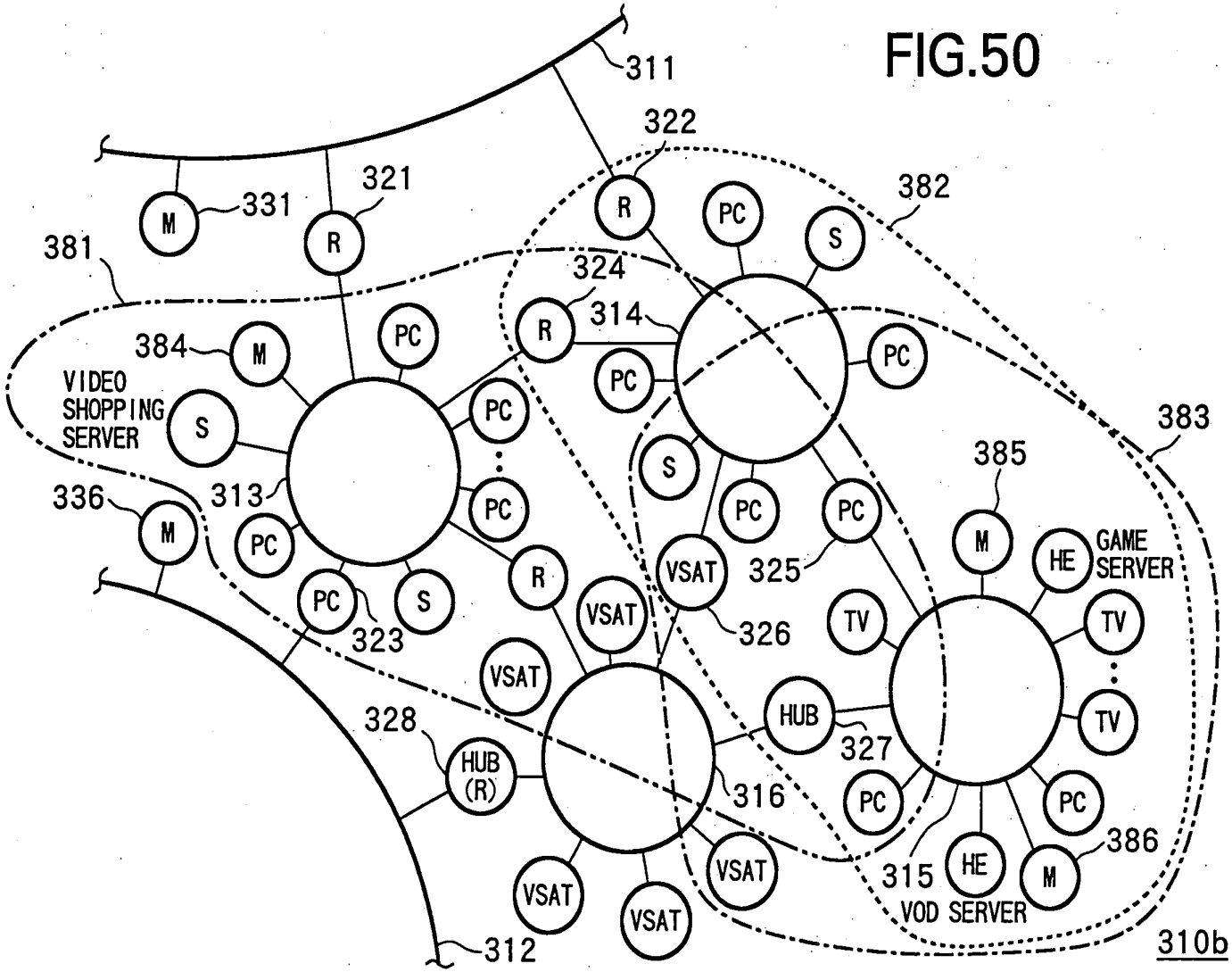


FIG.51A

```
Token:
(mediate instruction destination task result-handling token-ID
         origin-node origin-mediator token-sender co-successors)

Instruction:
search, connect, perform, or collect

Destination:
((name  "FOO Movie Services Server")
 (reference 'domain local node reference')
 (object-name  "package-server")
 (object-reference 'domain local object reference')
 (network-domain network-provider)
 (problem-domain "multimedia-network-service")
 (application-domain "video-on-demand")
 (communication-medium internet))

Task:
(object method arguments)

Result-Handling:
return-value, return-status, store, and/or propagate
```

FIG.51B

```
Token:
(mediate
      search
      ((name  "FOO Movie Services Server")
       (reference 'domain local node reference')
       (object-name  "package-server")
       (object-reference 'domain local object reference')
       (network-domain network-provider)
       (problem-domain "multimedia-network-service")
       (application-domain "video-on-demand")
       (communication-medium internet))
      (object method arguments)
      (return-value return-status)
      token-ID
      node-reference
      node-reference
      node-reference
      (node-reference node-reference ... node-reference)
      )
```

FIG.52

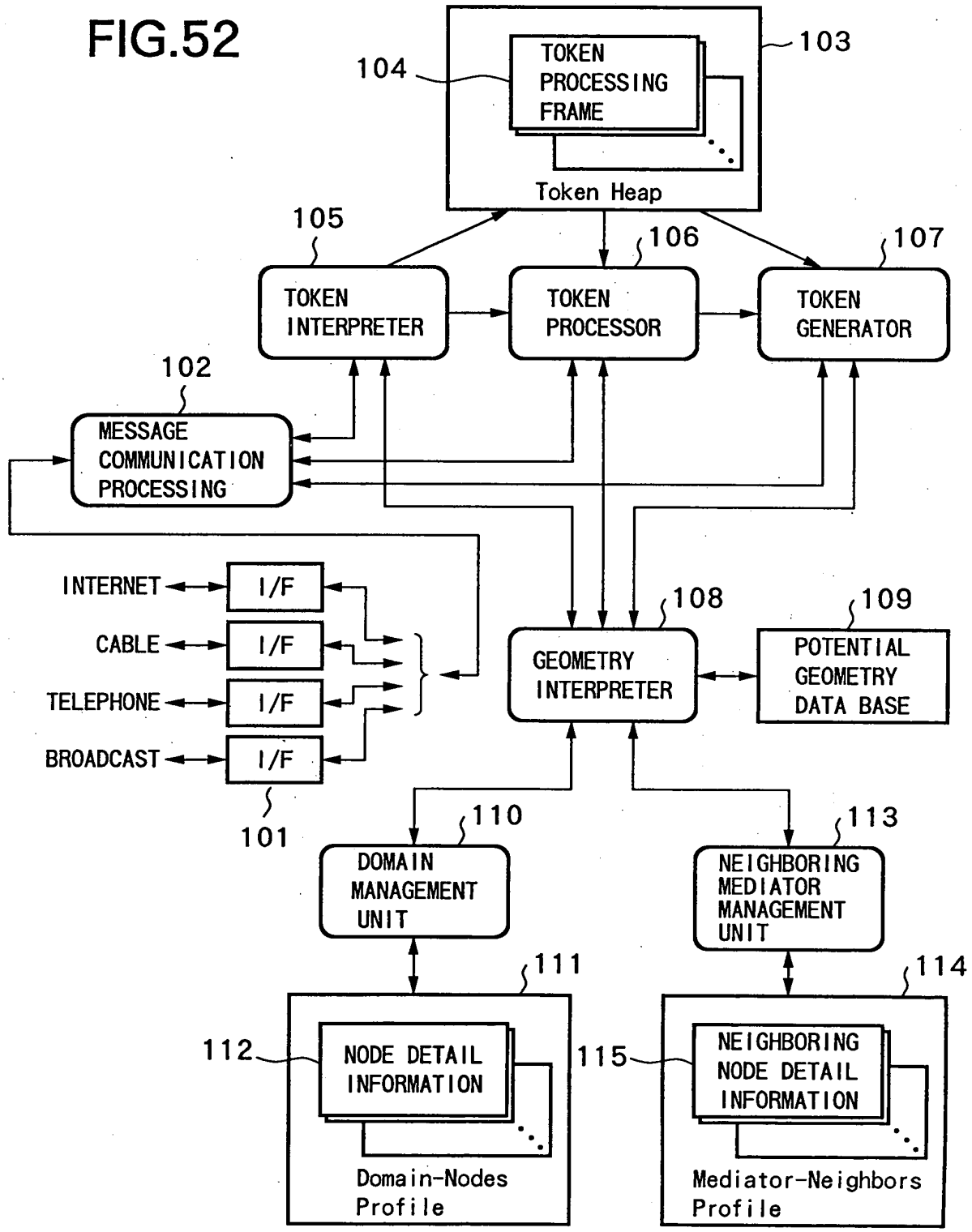

103
104
TOKEN PROCESSING FRAME
Token Heap
105
106
107
TOKEN INTERPRETER
TOKEN PROCESSOR
TOKEN GENERATOR
102
MESSAGE COMMUNICATION PROCESSING
INTERNET
CABLE
TELEPHONE
BROADCAST
I/F
I/F
I/F
I/F
101
108
109
GEOMETRY INTERPRETER
POTENTIAL GEOMETRY DATA BASE
110
113
DOMAIN MANAGEMENT UNIT
NEIGHBORING MEDIATOR MANAGEMENT UNIT
111
114
112
NODE DETAIL INFORMATION
115
NEIGHBORING NODE DETAIL INFORMATION
Domain-Nodes Profile
Mediator-Neighbors Profile

FIG.53

NAME	"FOO Movie Services Server"
REFERENCE	'domain-local-node-reference'
OBJECT NAME	"package-server"
OBJECT REFERENCE	'domain-local-object-reference'
NETWORK DOMAIN	network provider
PROGRAM DOMAIN	"multimedia-network-service"
APPLICATION DOMAIN	"video-on-demand"
COMMUNICATION MEDIA	internet

104 Token Processing Frame

INSTRUCTION	search
DESTINATION	
TASK	
PROCESSING RESULT	
TOKEN ID	token-ID
ORIGIN NODE	'node reference'
ORIGIN MEDIATOR	'node reference'
ARRIVAL NODE	'node reference'
ARRIVAL MEDIATOR	'node reference'
PREDECESSOR	'node reference'
SUCCESSOR	
PROCESSING STATE	delegating

object
method
arguments

return-value
return-status

'node reference'
'node reference'
⋮
'node reference'

86n060" 2E88nT60

FIG.54

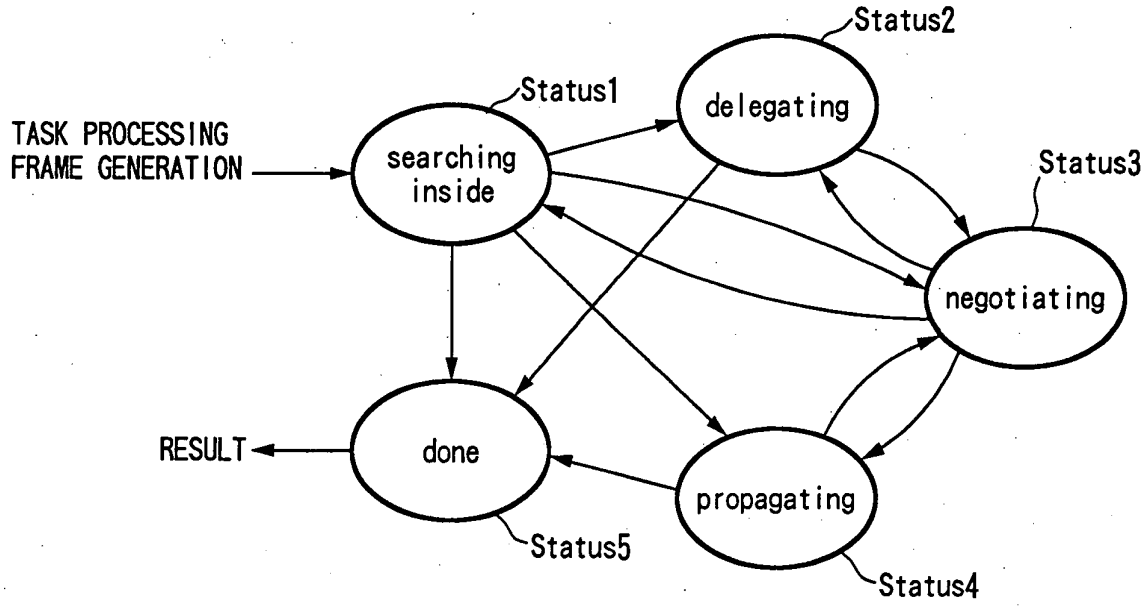


FIG.55

Netowork Domains

```
((domainN-1 (domainN-1i distance) (domainN-1j distance) ... (domainN-1k distance))
 (domainN-2 (domainN-2i distance) (domainN-2j distance) ... (domainN-2k distance))
 ...
 (domainN-N (domainN-Ni distance) (domainN-Nj distance) ... (domainN-Nk distance)))
```

Problem Domains

```
((domainP-1 (domainP-1i distance) (domainP-1j distance) ... (domainP-1k distance))
 (domainP-2 (domainP-2i distance) (domainP-2j distance) ... (domainP-2k distance))
 ...
 (domainP-N (domainP-Ni distance) (domainP-Nj distance) ... (domainP-Nk distance)))
```

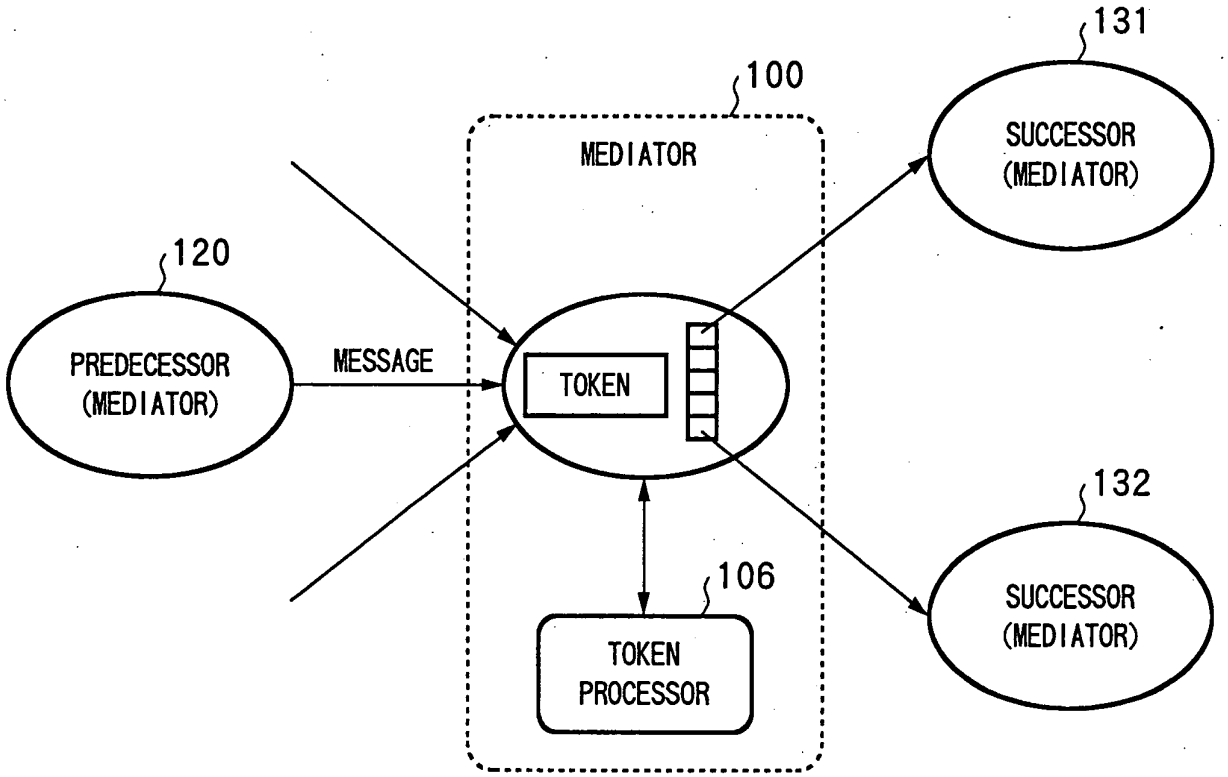
Application Domains

```
((domainA-1 (domainA-1i distance) (domainA-1j distance) ... (domainA-1k distance))
 (domainA-2 (domainA-2i distance) (domainA-2j distance) ... (domainA-2k distance))
 ...
 (domainA-N (domainA-Ni distance) (domainA-Nj distance) ... (domainA-Nk distance)))
```

FIG.56

NODE SERVER	VoD server
NODE NAME	XXX
REFERENCE	'node reference'
COMMUNICATION MEDIA	internet
OWNER NAME/REFERENCE	'node reference'
NETWORK DOMAIN	network provider
PROGRAM DOMAIN	multimedia network
APPLICATION DOMAIN	video-on-demand

FIG.57


131
100
MEDIATOR
SUCCESSOR
(MEDIATOR)
120
PREDECESSOR
(MEDIATOR)
MESSAGE
TOKEN
132
106
TOKEN
PROCESSOR
SUCCESSOR
(MEDIATOR)

86h060" 2E88hF60

FIG.58

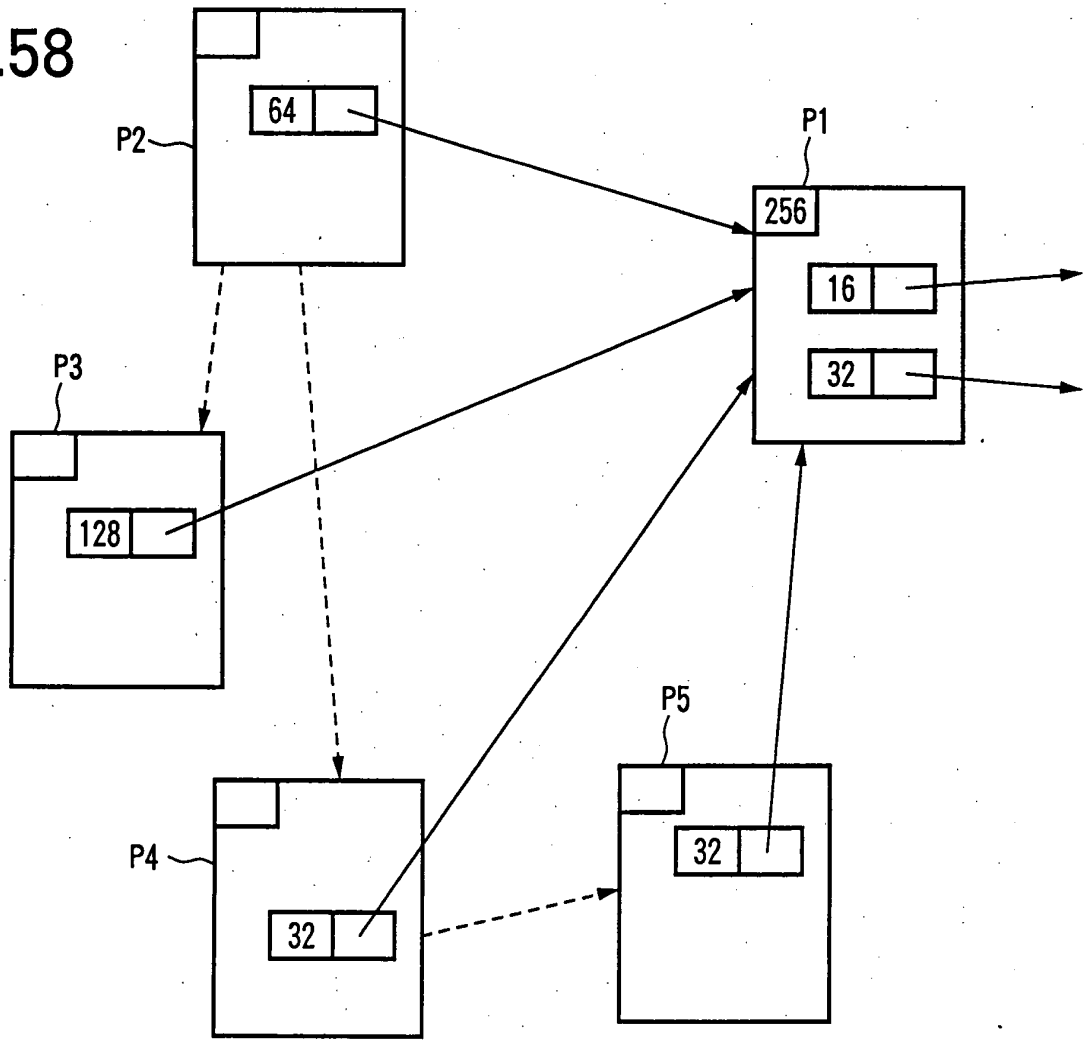


FIG.59

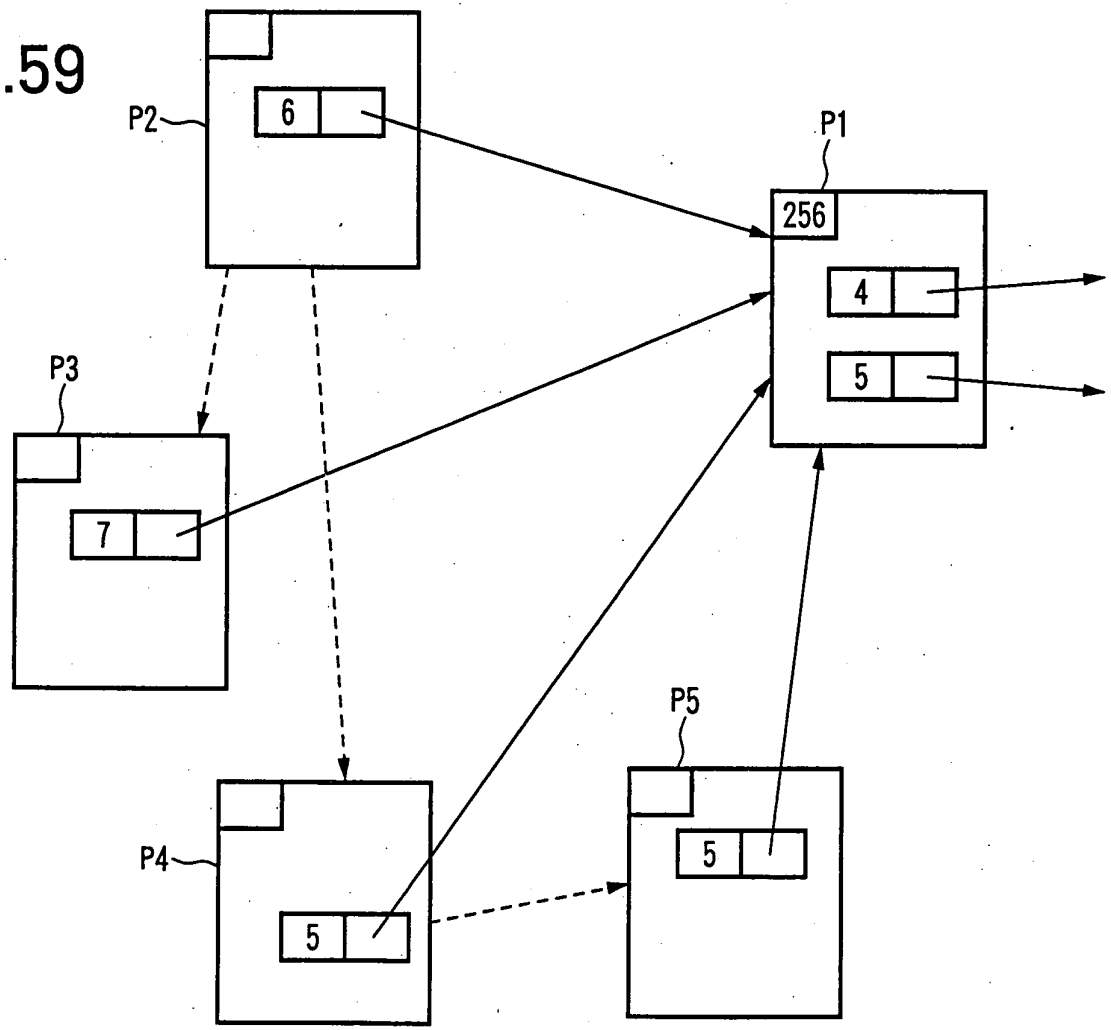


FIG.60

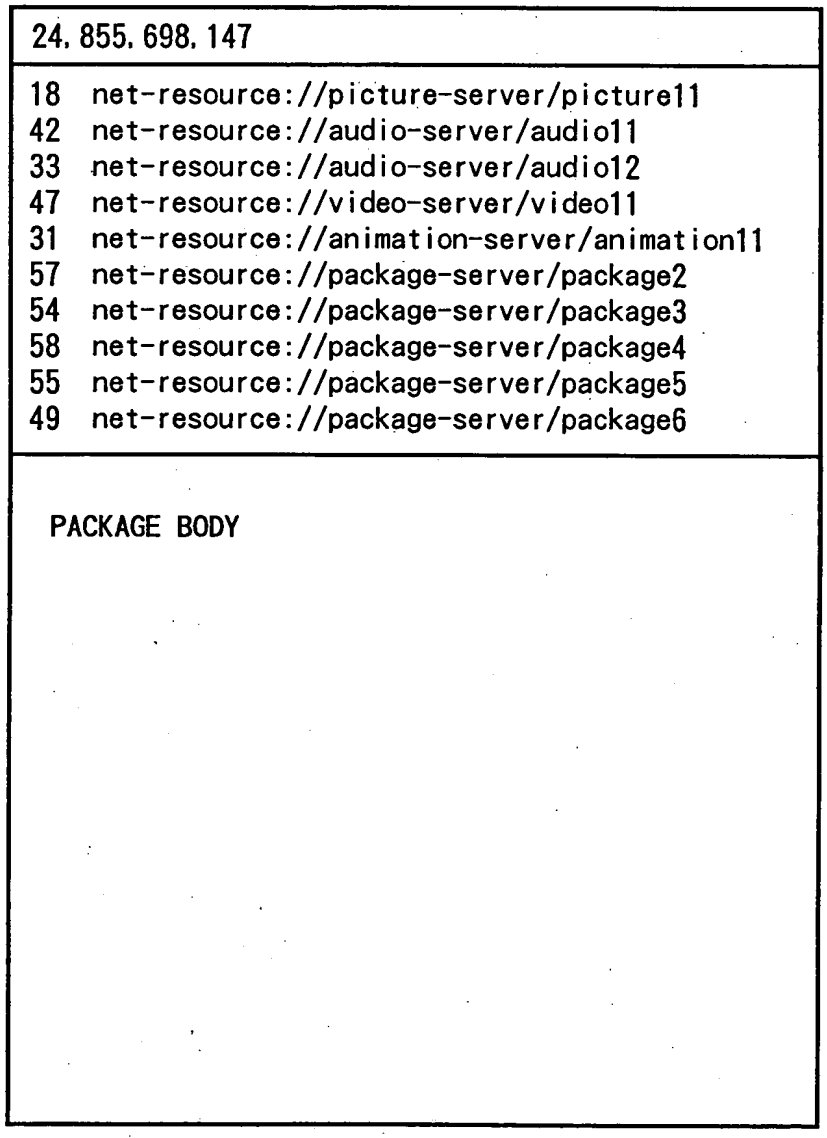

24, 855, 698, 147
18 net-resource://picture-server/picture11
42 net-resource://audio-server/audio11
33 net-resource://audio-server/audio12
47 net-resource://video-server/video11
31 net-resource://animation-server/animation11
57 net-resource://package-server/package2
54 net-resource://package-server/package3
58 net-resource://package-server/package4
55 net-resource://package-server/package5
49 net-resource://package-server/package6
PACKAGE BODY

FIG.61

```
<package>
  <title format=DVL version=2.0>
        <cover format=jpeg> & cover-description </cover>
        <name>"FOO Movie Services:Star Wars Trilogy" </name>
        <sort> CONTENT <minor-sort> MOVIE </minor-sort> </sort>
        <system> PACKAGE-PROCESSOR </system>
        <structure> <linkage> <local-link> & linkage-part </local-link> <linkage>
                <content-attributes> <local-link> & content-attribute-part </local-link>
                                </content-attributes>
                <control-attributes> <local-link> & control-attribute-part </local-link>
                                </control-attributes>
                <sequences> <local-link> & sequence-part </local-link> </sequences>
                </structure>
        <!ENTITY cover-description {jpeg data body}>
        </title>
```

FIG.62

```
<!ENTITY linkage-part
  <linkage>
    <link boundary=internal> <label> picture-link1 <label>
                net-resource://picture-server/picture31 </link>
    <link boundary=internal> <label> audio1-link1 <label>
                net-resource://audio-server/audio31 </link>
    <link boundary=internal> <label> audio1-link2 <label>
                net-resource://audio-server/audio32 </link>
    <link boundary=internal> <label> video-link1 <label>
                net-resource://video-server/video31 </link>
    <link boundary=internal> <label> package-link2 <label>
                net-resource://package-server/package2
                    <content>
                        <type> movie </type>
                        <provider> FOO Movie Services </provider>
                        <local-link> & content2 </local-link>
                        </content>
                    <control> admission-required </control>
                    </link>
    <link boundary=internal> <label> package-link3 <label>
                net-resource://package-server/package3
                    <content>
                        <type> movie </type>
                        <provider> FOO Movie Services </provider>
                        <local-link> & content3 </local-link>
                        </content>
                    <control> admission-required </control>
                    </link>
    <link boundary=internal> <label> package-link4 <label>
                net-resource://package-server/package4
                    <content>
                        <type> movie </type>
                        <provider> FOO Movie Services </provider>
                        <local-link> & content4 </local-link>
                        </content>
                    <control> admission-required </control>
                    </link>
  </linkage>
```

BY

FIG.63

```
<!ENTITY content-attribute-part
    <content-attributes>
      <type> movie </type>
      <provider> FOO Movie Services </provider>
      <date> 1 August 1997 </date>
      <items> 3</items>
      <material format=MPEG2> MOVIE </material>
      <content>
           &content1
           &content2
           &content3
           &content4
           </content>
      </content-attributes>
    <!ENTITY content1
      <content>
           <title> Star Wars Trilogy </title>
           <type> Science Fiction </type>
           <rating authority=MPAA> PG </rating>
           <screenplay> George Lucas </screenplay>
           <starring> Mark Hamill </starring>
           <starring> Harrison Ford </starring>
           <starring> Carrie Fisher </starring>
           </content>>
```

FIG.64

```
<!ENTITY content2
   <content>
        <title> Star Wars </title>
        <length unit=minute> 121 </length>
        <year> 1977 </year>
        <review reviewer=Leonard Maltin> **** </review>
        </content>>
<!ENTITY content3
   <content>
        <title> Empire Strikes Back </title>
        <length unit=minute> 124 </length>
        <year> 1980 </year>
        <review reviewer=Leonard Maltin> **** </review>
        </content>>
<!ENTITY content4
   <content>
        <title> Return of the Jedi </title>
        <length unit=minute> 133 </length>
        <year> 1983 </year>
        <review reviewer=Leonard Maltin> **** </review>
        </content>>
```

FIG.65

```
<!ENTITY control-attribute-part
  <control-attributes>
     <billing amount=3000 currency=JPY> package-based </billing>
     <admitted-consumers>
                    <certification> FOO Movie Customers </certification>
                    </admitted-consumers>
     <access-conditions> parental-guidance </access-conditions>
     <execution-environment>
                    </user-unit-requirement>
                       <hard-drive-space> 40 </hard-drive-space>
                       <memory-space> 8 </memory-space>
                       <graphics> 640×480×16 </graphics>
                       <audio> 16 </audio>
                       <user-unit-requirement>
                    </execution-environment>
     <encryption scheme=RSA key-sort=open> #87654321098765 </encryption>
     </control-attributes>>
```

FIG.66

```
<!ENTITY sequence-part
   <sequences>
    <!ENTITY picture1
          <picture hsize=300 vsize=200 color=256>
               <source> <local-link> picture-link1 </local-link> </source>
               </picture>>
    <!ENTITY audio1
          <audio sampling-size=16>
               <source> <local-link> audio-link1 </local-link> </source>
               </audio>>
    <!ENTITY audio2
          <audio sampling-size=16>
               <source> <local-link> audio-link2 </local-link> </source>
               </audio>>
    <!ENTITY video1
          <video hsize=450 vsize=300 color=16 frame-rate=30>
               <source> <local-link> video-link1 </local-link> </source>
               </video>>
   <!ENTITY dialog1
          <dialog>>
             <title> FOO Movie Services </title>
             <impose> <local-link> & content1 </local-link> </impose>
             Please Select Movie Title
             <action> take <local-link> package-link2 </local-link>
                       "Star Wars"
                        </action>
             <impose> <local-link> & content2 </local-link> </impose>
             <action> take <local-link> package-link3 </local-link>
                       "Empire Strikes Back"
                        </action>
             <impose> <local-link> & content3 </local-link> </impose>
             <action> take <local-link> package-link4 </local-link>
                       "Return of the Jedi"
                        </action>
            <impose> <local-link> & content4 </local-link> </impose>
            </dialog>>
```

FIG.67

```
<!ENTITY viewer1
        <viewer min-hsize=440 min-vsize=330> </viewer>>
<open-window> & viewer1 </open-window>
<before delay=0 max-skew=500 duration=2> & picture1 & audio1 </before>
<while delay1=0 delay2=0 max-skew=80> & audio1 & video1 </while>
<before delay=0 max-skew=500> & audio1 & dialog1 </before>
<cobegin delay=0 max-skew=120> & audio2 & dialog1 </cobegin>
</sequences>>
</package>
```

FIG.68

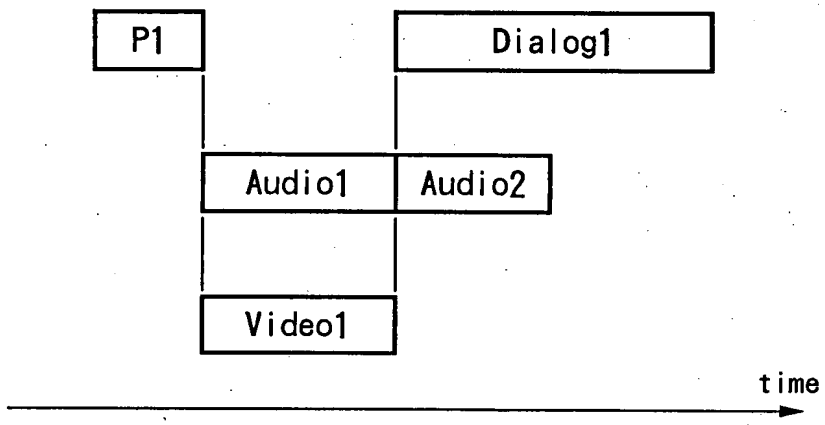


FIG.69

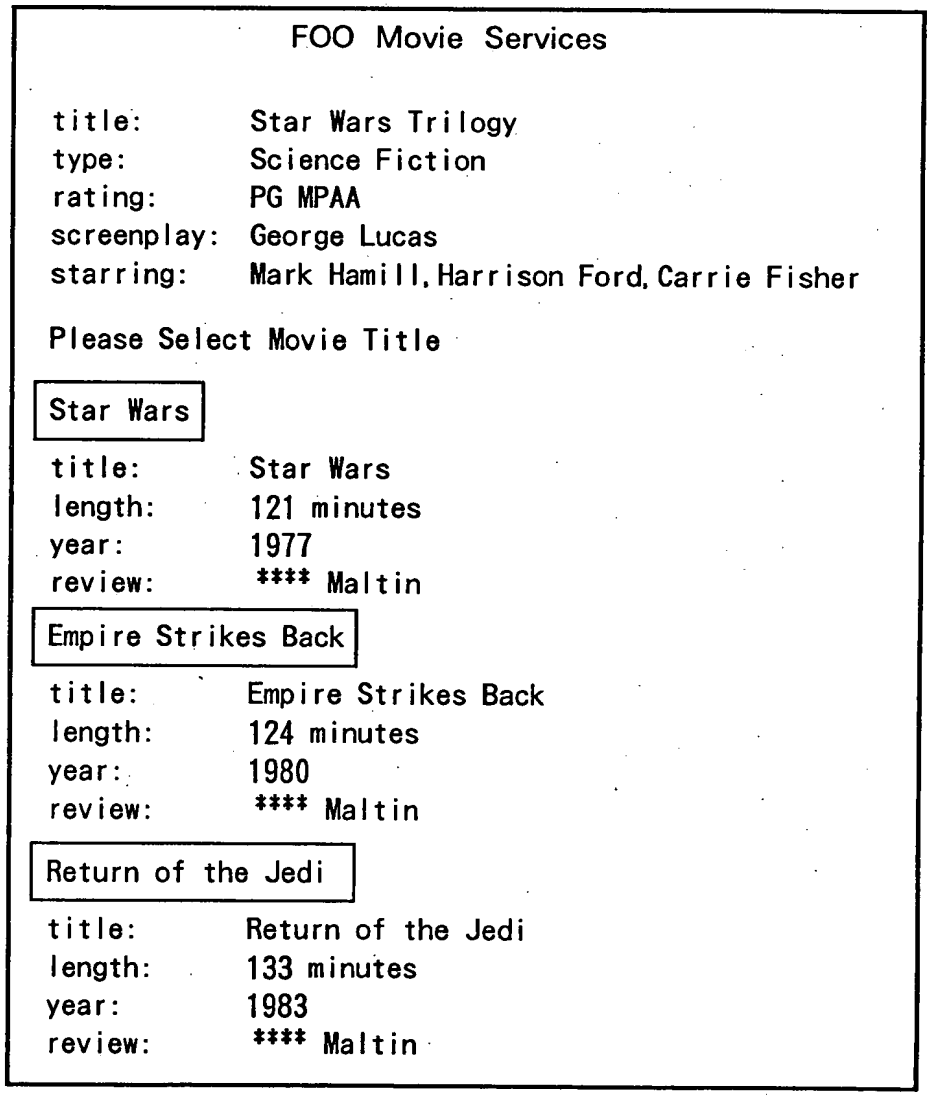

FOO Movie Services
title: Star Wars Trilogy
type: Science Fiction
rating: PG MPAA
screenplay: George Lucas
starring: Mark Hamill, Harrison Ford, Carrie Fisher
Please Select Movie Title
Star Wars
title: Star Wars
length: 121 minutes
year: 1977
review: **** Maltin
Empire Strikes Back
title: Empire Strikes Back
length: 124 minutes
year: 1980
review: **** Maltin
Return of the Jedi
title: Return of the Jedi
length: 133 minutes
year: 1983
review: **** Maltin

FIG.70

```
<package>
 <title format=DVL version=2.0>
   <cover format=text> Client Function Sample provided by
                  DVL Package Proccssing Systems </cover>
   <name>"DVL:Client Function Sample" </name>
   <sort> PROGRAM <minor-sort> Microsoft Windows </minor-sort> </sort>
   <system> PACKAGE-PROCESSOR </system>.
   <structure> <linkage> <local-link> & linkage-part </local-link> <linkage>
            <content-attributes> <local-link> & content-attribute-part </local-link>
                                 </content-attributes>
            <control-attributes> <local-link> & control-attribute-part </local-link>
                                 </control-attributes>
            <sequences> <local-link> & sequence-part </local-link> </sequences>
            </structure>
        </title>
   <!ENTITY linkage-part
      <linkage>
        <link boundary=internal> <label> server-link1 <label>
                        net-resource://sever-systems/movie-server-manager </link>
        </linkage>>
   <!ENTITY control-attribute-part
       <content-attributes>
        <type> control-program <type>
        <provider> DVL Package Processor Systems </provider>
        <release> April 1997 edition </release>
        </content-attributes>>
   <!ENTITY control-attribute-part
      <control-attributes>
        <billing > free </billing>
        <execution-environment>
                        </user-unit-requirement>
                          <operating> Windows 95 </operating-syatem>
                          <cpu-type-&-speed> Pentium 120 </cpu-type-&-speed>
                          <hard-drive-space> 4 </hard-drive-space>
                          <memory-space> 2 </memory-space>
                          <user-unit-requirement>
                       </execution-environment>
        </control-attributes>>
```

FIG.71

```
<!ENTITY sequence-part
    <sequences>
      <source-program language=C++type=header name="sample.hh">
        //-----------------------------------------
        // FILE: sample.hh

        PACKAGE(Client)        //DESIGNATE "Client" AS PACKAGE NAME

        class FOO {            //DEFINITION OF STRUCTURE TREATED AS
          public:              //MESSAGE ARGUMENT
            int i;             //INTEGER
            char* s;           //STRING
            double f;          //MULTIPLE PRECISION FLOATING NUMBER
            FOO() {            //CONSTRACTOR
              i=0;
              s=NULL;
              f=0;
            }
        };

        PUBLIC class BAR { //DEFINITION OF DISTRIBUTED OBJECT "BAR" CLASS
          //BECOMES CLIENT OBJECT IN COOPERATION WITH SERVER OBJECT
          public:
            int pid;         //OBJECT IDENTIFICATION INTEGER VALUE
            RemoteInstance server; //REFERENCE OF SERVER OBJECT
            //CONSTRUCTOR : INVOKED BY CREATEOBJECT
            BAR(int id, RemoteInstance ri) {
              pid=id;
              server=ri;
            }
            //DEFINITION OF METHOD "bee" OF DISTRIBUTED OBJECT
            PUBLIC char* bee(int i,char*s,FOO* foo) {
            //SEND MESSAGE TO CALL METHOD "FEE::fea"
            //TO OBJECT server OF PACKAGE "Server"
            //ARGUMENTS ARE: pid, "ABC"
              void Send(server, "Server:FEE::fea", pid, "ABC);
              return "ABC";
            }
        };
      </source-program>
```

FIG.72

```
<source-program language=C++type=main name="sample.cc">
   //-----------------------------------------
   // FILE: sample.cc

   #include "system.hh" //HEADER FILE OF DISTRIBUTED SYSTEM LIBRARY
   #include "sample.hh" //HEADER FILE OF SAMPLE PROGRAM
   #define SERVER "server-link1" //INDICATE REFERENCE OF LINK PART

   main(void)
   {
     //GENERATE INSTANCE OF CLASS "FEE" OF PACKAGE "server" IN
     //"SERVER" PROCESS (DESTINATION REFERENCE IS RESOLVED AT
     //LINK PART)
     RemoteInstance ServerObject =
       CreateObject(
         "Server:FEE", "SERVER");  //DESIGNATE LOCATION OF OBJECT
     //GENERATE INSTANCE OF CLASS "BAR" OF PACKAGE "client" IN
     //"local" PROCESS. AT THIS TIME, HAND REFERENCE OF
     //IDENTIFICATION INTEGER VALUE 1234 OF INSTANCE AND REFERENCE
     //OF SERVER OBJECT TO CONSTRUCTOR
     RemoteInstance ClientObject =

        CreateObject("Client:BAR", "local",
                     1234 , ServerObject);
     //GENERATION AND INITIALIZATION OF STRUCTURE TREATED AS MESSAGE ARGUMENT
     FOO* foo=new FOO;
     foo->i=789;
     foo->s="DVL";
     foo->f=3.14;

     //SEND SYNCHRONIZATION MESSAGE TO CALL METHOD "bee",TO
     //OBJECT INDICATED BY ClientObject
     //ARGUMENTS ARE INTEGER VALUE 98765,STRING "abcdef"
     //AND STRUCTURE foo STRING.
     //AS A RESULT OF CALLING IS SUBSTITUTED FOR retVal
     char* retVal=SyncCall(ClientObject,"client:BAR::bee",
                           98765,"abcdef", foo);

     return 0;
   }
   </source-program>
 </sequences>>
</package>
```

FIG.73

```
<package>
  <title format=DVL version=2.0>
      <cover format=jpeg> &cover-description </cover>
      <name> "FOO Movie Services:Service Manager Sites" </name>
      <sort> DOMAIN </sort>
      <system> PACKAGE-PROCESSOR </system>
      <structure> <linkage> <local-link> &linkage-part </local-link> </linkage>
            <content-attributes> <local-link> &content-attribute-part </local-link>
                                 </content-attributes>

                </structure>
      <!ENTITY cover-description {jpeg data body}>
      </title>
  <!ENTITY linkage-part
     <linkage>
      <link boundary=external> <label> server-link1 </label>
                net-resource://server-manager1/FOO-movie-server-manager</link>
      <link boundary=external> <label> server-link2 </label>
                net-resource://server-manager2/FOO-movie-server-manager</link>
      <link boundary=external> <label> server-link3 </label>
                net-resource://server-manager3/FOO-movie-server-manager</link>
      <link boundary=external> <label> server-link4 </label>
                net-resource://server-manager4/FOO-movie-server-manager</link>
      <link boundary=external> <label> server-link5 </label>
                net-resource://server-manager5/FOO-movie-server-manager</link>
      </linkage>>
  <!ENTITY content-attribute-part
     <content-attributes>
      <type> server-manager
                    <local-link> server-link1 </local-link>
                    <local-link> server-link2 </local-link>
                    <local-link> server-link3 </local-link>
                    <local-link> server-link4 </local-link>
                    <local-link> server-link5 </local-link>
                    </type>
      <provider> FOO Movie Services </provider>
      <release> June 1997 </release>
      </content-attributes>>
</package>
```